NOVEMBER 21, 1955

NEWS ISSUE

Electrical World

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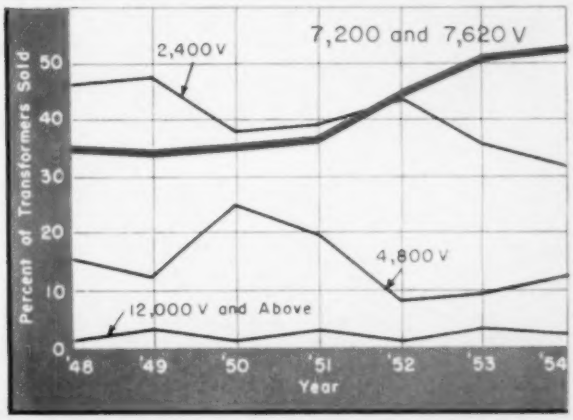

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What Price Federal Power?

Task Force Chief Asks Support . . . . . Page 44

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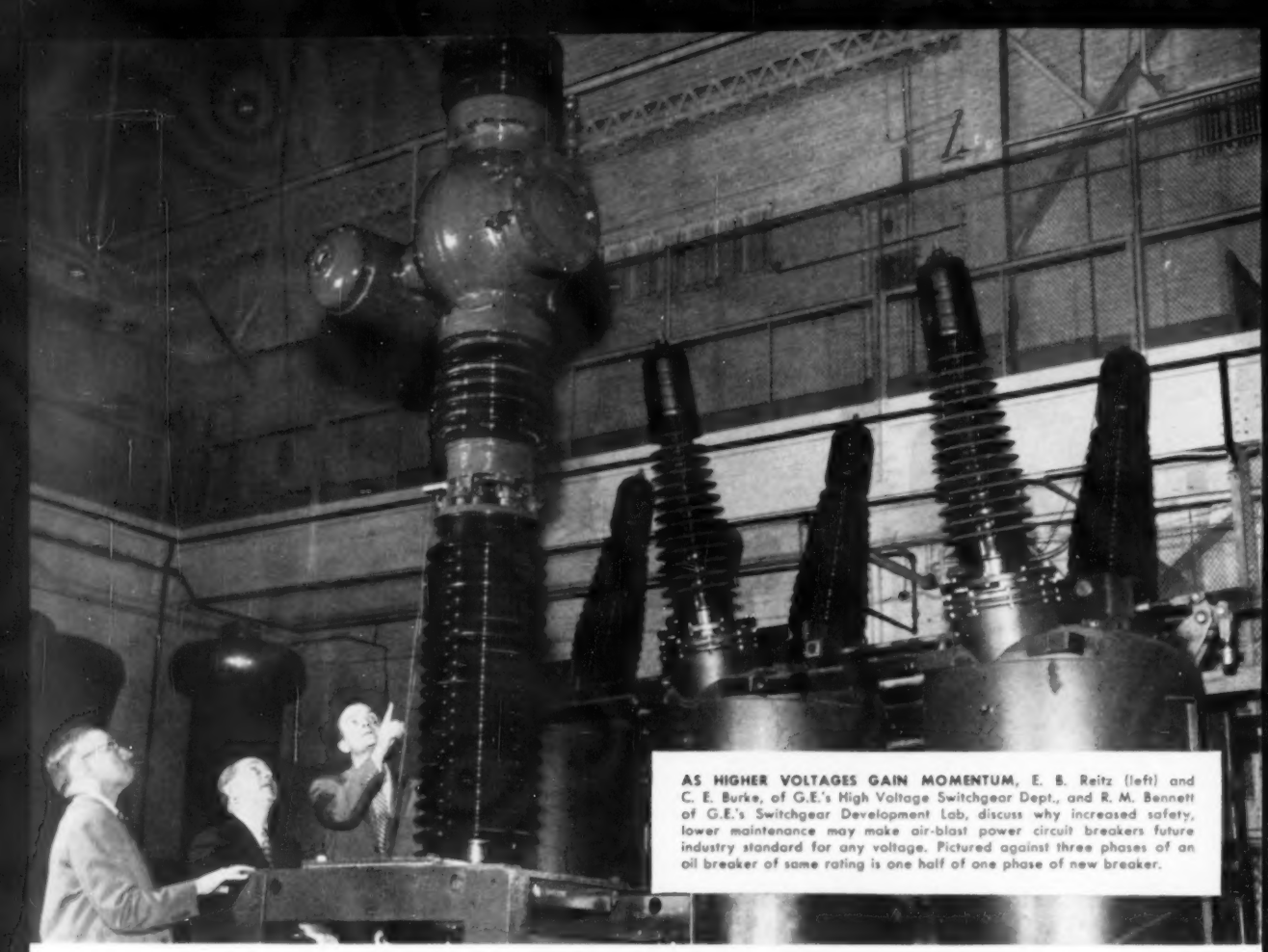

AS HIGHER VOLTAGES GAIN MOMENTUM, E. B. Reitz (left) and C. E. Burke, of G.E.'s High Voltage Switchgear Dept., and R. M. Bennett of G.E.'s Switchgear Development Lab, discuss why increased safety, lower maintenance may make air-blast power circuit breakers future industry standard for any voltage. Pictured against three phases of an oil breaker of same rating is one half of one phase of new breaker.

Revolutionary new air-blast power circuit breaker marks . . .

Beginning of new era in transmission system protection

For electric utility engineers concerned with reducing transmission system operating costs, General Electric's new 138-kv air-blast circuit breaker offers real opportunity to meet continually rising loads with modern, efficient electrical apparatus at minimum cost.

Developed for the Consolidated Edison Company of New York, the new breaker, is the first air-blast power circuit breaker manufactured in the United States. The 138-kv breaker, based on 15 years of G-E research on air-blast interruption, is the first of a complete line of breakers through 330 kv, which are expected to be available within two to three years. Prices are to be comparable to those of oil breakers of the same ratings.

COST SAVINGS FORECAST

From the viewpoint of operating expenditures, the newly available air-blast breaker should provide utilities with considerable maintenance savings, as well as some relief from the critical manpower shortage. Maintenance requirements can be reduced radically because of absence of oil. Initial filling, scheduled oil filtration and refilling are eliminated.

General Electric engineers are searching constantly for ways to help electric utilities reduce operating costs. The new air-blast breaker provides ample testimony to how this research is paying off. For full information on the new breaker, contact your nearby G-E Apparatus Sales Representative. General Electric Company, Section 301-315, Schenectady 5, New York. 301-315

MORE POWER TO AMERICA

GENERAL ELECTRIC

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Electrical World

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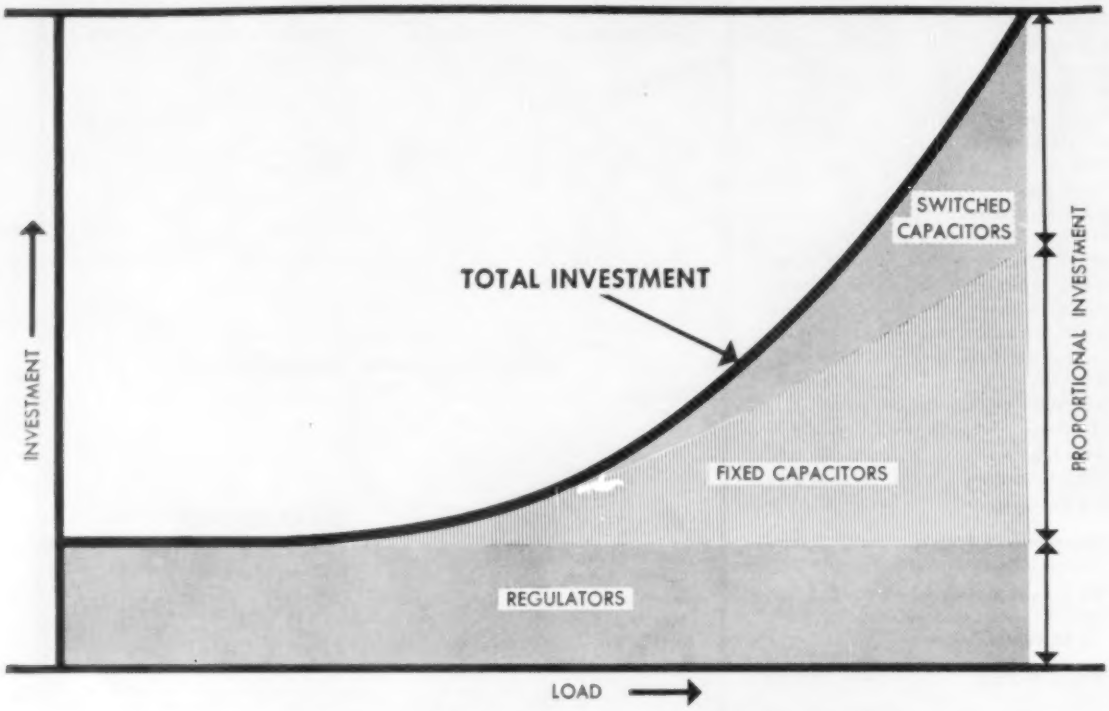
COMING NEXT WEEK—EEI is publishing an Underground Systems Handbook based on a survey of present day practices. EW will present the data from a portion of this survey.

OPERATION VOLTAGE REPORT NO. 4

Key facts for the optimum investment for regulation



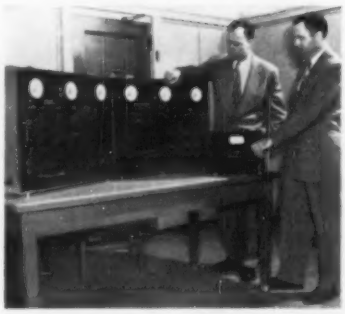
Conclusion; DEFER NEW LINE INVESTMENT BY USING REGULATORS *PLUS* CAPACITORS

It has been established by a comprehensive study of the voltage problem that a combination of regulators and capacitors does the best job of holding voltage . . . and at a lower cost, too. To utility planners, the results of this study are a guide to programmed expenditures for retaining desirable consumer voltages as loads increase.

A suggested program for equipment procurement is shown above. Ideally, an investment in feeder voltage regulators should predominate at light loads and hence these should be purchased initially. As more load is added, fixed capacitors should be utilized to increase load capability. Finally, at heavy loads, switched capacitors should be added along with more fixed units. The greater investment at these heavier loadings should be in such power-factor improving equipment.

Only when thermal limitations or excessive line losses appear, should it be necessary to rebuild the line. The result is that costly line reconstruction is delayed until absolutely necessary, and consumers continue to get good voltage.

This is the last in a series of reports designed to acquaint you with the results of Operation Voltage. For a complete discussion, contact your G-E Apparatus Sales Engineer or write for GER-1029. General Electric Company, Schenectady 5, N. Y. 645-4



Portable demonstrator being used by G-E engineers R. M. Butler and D. R. Samson to show effects of capacitors and regulators under variety of feeder load conditions.

GENERAL ELECTRIC

EDITORIALS

Back Up the Challenge

Georgia Power Co has performed a timely and worthwhile service to the industry by forthrightly challenging the Attorney General's opinion with regard to marketing power from the federal Clark Hill project. To give full effect to this considered challenge, electric companies over the nation now owe it to themselves to give active and unremitting support to the stand taken by the Georgia utility.

While the Brownell opinion has no legal standing, it does take its place in Administration Power policy. Administration spokesmen have already indicated adherance to it.

From a procedural standpoint, it was vitally important that the advisory opinion of Attorney General Herbert Brownell, Jr, be contested. For, as Georgia Power Pres Harllee Branch, Jr, wrote in his letter to Brownell, "to permit your opinion to go unchallenged might have the effect of indicating acquiescence in it." In the field of politics, just as in the court room, it is necessary that a record be built if a case is later to be argued. Unfortunately at the moment there is no clear cut opportunity to present the case before an appropriate forum.

From the standpoint of substance it is even more important that a challenge has been made. As pointed out recently on this page (EW, Oct. 24, p 5), the Brownell opinion on the marketing of federal power serves to undermine the previously stated policy of the Eisenhower Administration. The opinion which parallels in part the marketing memorandum issued by the late Interior Secretary, Harold Ickes, sets up the preference clause of the 1944 Flood Control Act as the controlling directive. It ignores the equally important directives that federally produced power and energy be disposed of in "such manner as to encourage the most widespread use thereof" and "at the lowest possible rates to consumers consistent with sound business principles."

The memorandum submitted by Branch argues that if the Brownell opinion is followed to its logical conclusion, the Secretary of Interior would be required to sell federal power to a preference customer no matter what rates the ultimate consumers would have to pay. In the Clark Hill situation, the ultimate customer might have to pay as much as 10 mills for power if the federal government or the preference customers had to provide the transmission facilities. This compares with 6.23 mills under the contract which the Interior Department had previously offered.

It is widely recognized that the marketing procedures finally adopted for the Clark Hill project will set a pattern for other marketing areas. Thus a broad segment of the industry has a stake in the legal battle being waged at Clark Hill. Now that the challenge has been made, electric companies have no choice but to follow it up with the means at their disposal.

At this time it appears that legislative action may be necessary to add further emphasis to the past directives of Congress. If that be the case, electric utilities have an educational job in acquainting the public with the marketing issue and the drastic implications of the Brownell opinion.

Confusion over Fusion

Utility engineers along with the laymen stand in awe of the momentous promise of the controlled fusion reaction. There is the long-range potential of practically limitless amounts of useful energy being derived from the light elements such as hydrogen and its isotopic forms. This promise opens vast new fields of technology and potential fuel economy.

The highly theoretical research now in progress raises one very practical and down-to-earth question for utilities. Should they forge ahead in studies on the thermal plants employing uranium, or should they wait a few years to put development dollars in controlled fusion?

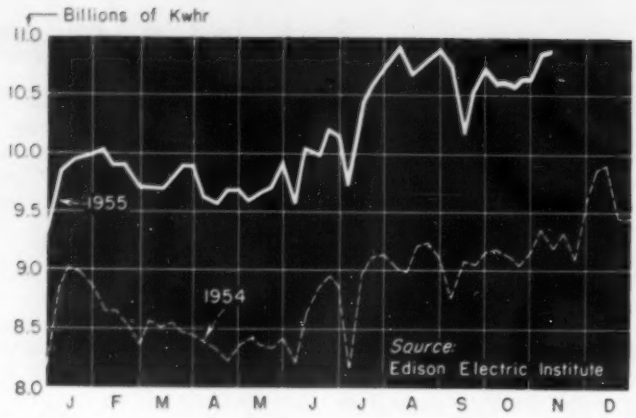
On this score AEC Chairman Lewis L. Strauss and members of his staff have tried to give a measure of reassurance. At a recent press conference they alluded to a 20 to 30-year period of research and development required to bring fusion into utility technology. Costs of the first uranium plants will be substantially amortized before there is any chance of fusion entering the picture, said one AEC staff member.

This reassurance is weakened somewhat by the startling progress which ushered in the H-Bomb. A breakthrough, a streak of genius, helped achieve the explosion some three years after the intensive research and development program was set up. This is probably in the minds of utility men who must plan ahead and count their research eggs carefully.

Unfortunately the occurrence of such breakthroughs are beyond the realm of reasonable forecasting. And despite the rosy promises of nuclear fission, the refinement and progress in the development of conventional thermal units goes on apace as is attested by the results of the steam station costs survey printed in our Oct. 17 issue.

At this stage of our knowledge, it appears reasonable and prudent to continue intensive development and refinement of both the conventional fuel and the fission stations. Initial studies indicate that the small possible economies of nuclear fission will dictate that they supplement rather than supplant the need for fossil fuels. It is not unreasonable to believe that the fusion reaction must take a similar position when all factors are considered.

In any event no engineering can be done until the fusion process is off the blackboards, out of the theoretical stage. To hold back on the research and engineering immediately at hand is only to let the promise of progress hold back progress, itself.



OUTPUT

Week Ended Nov. 12
10,878,000,000 Kwhr
Up 18.3%

Atomic Energy Commission requirements — 1,061,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 13.0%

Per Cent Change from Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 12	+18.3	+10.6	+9.9	+30.3	+12.4	+20.2	+13.7	+15.6	+13.8	+12.4
Nov. 5	+16.0	+10.9	+8.8	+27.2	+8.1	+16.1	+13.5	+14.9	+12.5	+11.5
Oct. 29	+16.5	+9.6	+9.3	+28.3	+8.3	+19.0	+11.2	+16.9	+8.3	+11.6

Seasonally Adjusted Index 207.2 Week Ago 207.4 Year Ago 174.8

The Issue's Highlights—New York State Power Authority votes three to two to build its own transmission line for St. Lawrence power; dissenter questions legality of plan . . . APDA announces start of construction on test reactor facility with components usable on proposed subsequent nuclear power plant . . . Harllee Branch criticizes Attorney General Brownell's opinion on Clark Hill power . . . J. W. Corey named new NEMA president . . . EEI's 18th semi-annual power survey forecasts 19.8% reserve margin for nation in 1958 . . . Interior sets "Buy American" policy on electrical equipment.

Clark Hill—Georgia Municipal Association, representing 22 Georgia cities, has found "unacceptable" Interior's proposed Clark Hill power contract. Objection of these preference customers is to limitation on distribution to 150-mi radius (thus excluding some of their members), and no provision for sharing in future power from Hartwell, Buford, and Ft. Gaines dams. These problems would not exist if Georgia Power could take over the power for distribution.

Capacity Added—Commonwealth Edison put into operation last week 160,000-kw steam generating unit at its Ridgeland station which exploded last December. Company also brought into service 207,000-kw unit at its State Line plant.

Election Results—Waterville, Ohio, residents voted 307 to 305 to sell their municipal electric plant but 301 to 293 to issue $155,000 in bonds to improve the plant . . . Amherst, Ohio, citizens voted 660 to 536 to sell their municipal plant . . . Miamisburg, Ohio, voters approved rejection of the City Council's action to continue with an expansion of the city light system.

Dixon-Yates—Senate Judiciary anti-monopoly subcommittee took another swing at Dixon-Yates contract in effort to keep an accusation alive. The accusation: Attempt to influence testimony of Dr. F. Kellogg of Mississippi School of Engineering, an anti-Dixon-Yates witness.

Washington Wire—Interior Secretary McKay told Vermont audience public-vs-private power fight boils down to question of whether billions of dollars of power development in West will be paid for by taxpayers . . . Jones subcommittee on water resources and power moves West with hearing scheduled this week in Chicago.

NEWS OF THE INDUSTRY BRIEFLY TOLD

NEMA—At annual meeting in Atlantic City, N. J., last week NEMA, in addition to electing new president (p 8), appointed following vice presidents: F. F. Loock, president, Allen-Bradley Co; J. J. Mullen, Jr, president, Moloney Electric; B. C. Neece, president, Landers, Frary & Clark; W. V. O'Brien, vice president, General Electric; and J. L. Singleton, vice president, Allis-Chalmers. Officers Committee at Large elected N. J. MacDonald, president, Thomas & Betts, and Hoyt P. Steele, president, Benjamin Electric Manufacturing, as members. Following were renamed as appointed members of the board: W. R. Persons, president, Emerson Electric Manufacturing; G. T. Pfleger, president, U. S. Electrical Motors; and J. S. Thompson, president, Federal Pacific Electric . . . Plans were announced for program to step up attack on inadequate wiring. Commercial and institutional wiring program, like residential wiring activity, will be coordinated by National Adequate Wiring Bureau as another all-industry project . . . Competitive Fuels subcommittee announced national contest next year to reward both utility companies and REA co-ops which do outstanding sales promotional jobs on major electrical appliances . . . Electric Housewares Section re-affirmed its intention to carry on vigorous industry-wide gift promotion program.

ABOUT PEOPLE IN THE INDUSTRY

Highlight of NEMA annual meeting was panel discussion by four leaders on outlook for electrical manufacturing industry. **Gwilym A. Price,** Westinghouse Electric president, in talk read by Vice President J. A. Jewell, predicted that by 1973 residential consumption of electricity for first time in our history will equal industrial consumption. "As an industry we will have to sell more than 1¾ billion appliances if we are to reach this crossroads in 1973." Price estimated consumers would have $37 billion more to spend on appliances five years from now . . . **Don G. Mitchell,** chairman and president, Sylvania Electric, envisioned total electrical products shipments of $35 to $40 billion by 1965, and $15 to $20 billion of electronics products alone by 1960. "If there were no increased mechanization for next few years, electronics industry would need working force exceeding a million, perhaps 1¼ million. It wouldn't be available. To meet our opportunities, we are depending upon a broader and broader use of the machine to give our working force the increased skill and productivity which the future will demand. If electrical industry . . . is to realize its vast potentials . . . the machine is the only answer" . . .

Hoyt P. Steele, president, Benjamin Electric Manufacturing, noted that proposed constitution of merged AFL-CIO gives clear indication that new labor organization will devote much of its time, money and energy to influence political and economic factors in our society. "They don't even overlook the objective of influencing the foreign relations of this country." On question of secondary boycotts, he warned that next few years would require "thorough understanding of the terrible dangers involved and the fact that partly, at least, through this power, we have given labor unions the ability to destroy the American enterprise system." Unfair boycotts have increased in number and grown in severity because of a series of technical loopholes in the law, he said . . .

Robert S. Stevenson, president of Allis-Chalmers Manufacturing, predicted a $21 billion market in next 10 years for heavy generating and transmission equipment based on assumption that utility loads would double in this period. "We are currently in slight dip in manufacturing and shipping which I expect will continue until middle or latter part of 1956. This dip is reflection of low level of order booking that took place in last half of 1954." Stevenson said manufacturing will revive in latter part of 1956.

More News About People page 36

N.Y. Agency Votes to Build Own Line

- **Power Authority facility will transmit St. Lawrence power to 3 customers**
- **Dissenting vote questions legality; utilities in area asked to participate**

The New York State Power Authority has voted, three to two, in favor of building its own transmission line from the St. Lawrence River to deliver a total of 140,000 kw to three customers.

Two private utilities—New York State Electric & Gas Co and Niagara Mohawk Power Corp—were asked to participate in the new system but both have opposed the line.

The authority's plans to construct the line have been a point of contention for some time between the state agency and New York private utilities. New York State Electric & Gas Co, in its recent prospectus, stated, "If the authority goes forward with its plans to construct such transmission facilities, the company intends to test the power of the authority to do so."

At its recent meeting the Authority also approved contracts to sell 100,000 kw of St. Lawrence power to the State of Vermont; 30,000 kw to the City of Plattsburg, N. Y.; and 10,000 kw to the Air Force Base at Plattsburg.

To transmit the power involved, the Authority announced that it would follow one of two plans: (1) Construct two parallel lines between Massena where power will be generated and the Plattsburg area; or (2) Build only one line and utiliize private facilities which would be "strengthened."

Under the second plan, New York State E&G and Niagara Mohawk would provide emergency, supplementary, and "back-up" transmission once their lines had been strengthened with new conductors or heavier insulators. It was this alternate proposal which offered the utilities a chance to participate in transmitting the power. They were given 30 days to think it over.

From the authority's own ranks came an indication that New York State E&G stood on solid ground if it decided to push the issue into court.

John E. Burton, in casting one of the dissenting votes, said he objected to the authority line because it violated the law under which the agency operates. He cited a provision in the law which states that private transmission facilities must be used if available. Private companies, he pointed out, had agreed to supply the facilities at reasonable costs.

Authority Chairman Robert Moses contended that the private facilities were insufficient to move the quantity of power involved. Authority engineers, he pointed out, also had stated that transmission costs would be reduced substantially if authority lines were constructed.

The quantity of power contracted for was also questioned by Burton. The amount slated for the City of Plattsburg, he claimed, was six times the city's normal needs and could be utilized only if a large new industry located in the vicinity.

J. W. Corey Named NEMA President

J. W. Corey, president of Reliance Electric & Engineering Co, Cleveland, was elected president of National Electrical Manufacturers Association at its annual meeting last week in Atlantic City. He succeeds Albert F. Metz, chairman of board and chief executive officer of Okonite Co.

Corey has been a NEMA vice president and board member. He is also a director of National Association of Manufacturers.

After joining Reliance in 1913, Corey served as general sales manager, director of the company, and vice president-sales. He was named president in 1944, and in 1950 he was elected director and president of the company's Canadian subsidiary in Ontario.

Test Reactor Facility Being Built by APDA

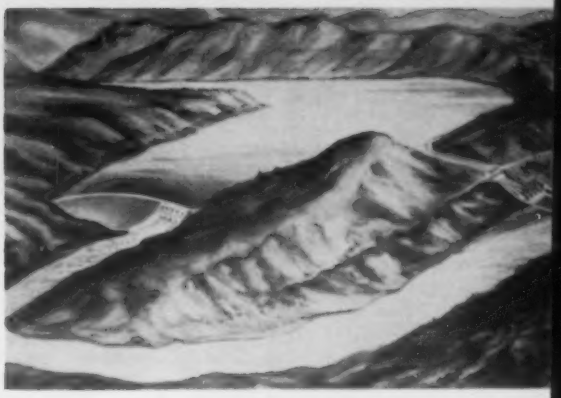
Atomic Power Development Associates, Inc, announced last week that construction is under way on an atomic power reactor test facility at Detroit Edison Co's Delray Station.

Contracts have been signed for detailed design of the test facility and for construction of various components with the Byron Jackson Division of Borg Warner Corp; Combustion Engineering, Inc; Commonwealth Associates, Inc; General Electric Co; and United Engineers & Constructors. A special high-temperature boiler section for use in a test separate from those at Delray is being constructed by Babcock & Wilcox Co.

The Delray unit includes full-size parts of an atomic-fueled electric power plant and will afford a full-scale operating test, without the nuclear fuel, of the key mechanical components of the fast-neutron breeder reactor being designed by APDA. These components may be used in the actual reactor plant after tests are completed (see page 25). The project was first announced by APDA last February.

Components now under procurement include the reactor vessel, the rotating shield plug assembly, offset handling mechanism, and sodium pump.

Cost of the facility has been estimated at $4.3 million.



Idaho Power Signs Contract for Work on 2 Snake Dam Sites

Contract for preliminary work on the Brownlee and Oxbow Dam sites on the Snake River have been signed by Idaho Power Co with Morrison-Knudsen Co, Inc.

T. E. Roach, president of the utility, said work will begin immediately. Morrison-Knudsen will build access roads to the two dam and powerhouse sites.

Brownlee Dam (above left) will be 400 ft high making it one of the 15 highest in the world. Installation of three generating units will yield 360,000-kw initial output.

Oxbow Dam (right), 12 mi upstream from Brownlee, will be 200 ft high with power output of 151,000 kw. The hairpin turn in the river from dam site to powerhouse is almost three miles long.

Third part of Idaho Power's Snake River project is Hells Canyon Dam slated for later construction 23 miles downstream from Oxbow.

Branch Scores Brownell's Clark Hill Opinion

Harllee Branch, president of Georgia Power Co, has questioned the recent legal opinion by Attorney General Herbert Brownell, Jr, regarding distribution of power from Clark Hill Dam on the Savannah River near Augusta, Ga. (EW, Oct. 24, p 51).

In a letter to Brownell made public last week, Branch said the opinion, if followed, would "convert what was intended only as a 'preference' into a virtual 'monopoly' in favor of the subsidized power groups."

The Attorney General's opinion was disclosed last month in House subcommittee hearings conducted by Rep Earl Chudoff (D-Pa.) to investigate government power policies.

Basis for Brownell's View

Brownell held that under Section 5 of the Flood Control Act of 1944, "when the Secretary of the Interior has before him two competing offers to purchase power, one by a preference customer and the other by a non-preference customer, and the former does not have . . . the physical means to take and distribute the power, he must contract with the preference customer on condition that such customer will, within a reasonable time to be fixed by the Secretary, obtain the means for taking and delivering the power."

Branch asserted that the opinion took into account only one provision of the 1944 law governing disposition of power from federal hydro projects and disregarded several specific Congressional directives.

Other Precedents Disregarded

The neglected directives, Branch pointed out, included requirements that surplus government power be disposed of in such manner "as to encourage the most widespread use thereof;" "at the lowest possible rates to consumers;" and "consistent with sound business principles."

The utility president added that "failure to give effect to these important provisions of the law in our view results in a distortion of Congressonal intent and, if adhered to, would enlarge the preference clause in favor of subsidized power groups beyond what was contemplated when Section 5 was enacted."

Brownell's opinion, Branch asserted, also was not in accord with the intent of Congress indicated in House and Senate hearings reviewing the earlier tri-contract proposal and in a debate on the Senate floor.

The Attorney General, Branch added, also overruled earlier opinions of counsel for Interior Department under both Democratic and Republican leadership, one as recent as the spring of 1954.

In conclusion, Branch said, "This letter is written . . . because we felt that to permit your opinion to go unchallenged might have the effect of indicating acquiescence in it."

Predict Echo Park Out

Elimination of Echo Park Dam from construction plans has been predicted to hasten approval by Congress of the multi-million-dollar Upper Colorado River development program, according to Congressmen from four western states, Colorado, New Mexico, Utah, and Wyoming. Besides agreeing to support four storage dams and reservoirs to be included in the bill, they also voted for eleven participating projects, mainly reclamation, which were turned down by the House at the last session.

EEI Predicts 19.8% Reserve

. . . for 1958 but 18th semi-annual power survey shows decline of forecasted margins for Northwest and West Central regions

Edison Electric Institute, in its 18th Semi-Annual Electric Power Survey, has forecast a reserve margin of 19.8% for the entire nation in 1958 when capability will then be increased to 141,365,000 kw.

This margin of capability over peak load forecast in the current survey coincides closely wth the 19.3% reserve predicted by EEI in its 17th semi-annual survey last spring (EW, May 16, p 90).

However, reserve forecasts vary considerably in the two surveys for the Northwest and the West Central regions. In the spring, a 1958 reserve of 37.4% was forecast for the West Central. This now has been revised downward to 27.7%. And for the Northwest, the reserve predicted for 1958 has declined from 21.4% to 11.5%.

In the current survey, the reserve prediction for the nation in 1958 is somewhat lower than the 20.7% reserve calculated for 1954 but higher than the 18.9% forecast for 1955 and the 19.3% for 1956.

The reserve for 1955 is based on a capability of 115,474,000-kw capability and a 97,125,000-kw peak load. The margin for 1956 is based on a forecasted capability of 123,790,000 kw and a peak load of 103,738,000 kw.

For 1957, the EEI survey indicates that the margin will again decline to the 1955 level of 18.9% with 131,880,000-kw capability and 110,946,000-kw pk peak load. Pushing up the national total again in 1958, electric suppliers are expected to achieve a reserve margin of 19.8%, capability of 141,365,000 kw, and peak load of 118,032,000 kw.

CMP Launches 100,000-kw Plant

First ground has been broken to start construction on a new 100,000-kw steam plant for Central Maine Power Co.

Manning the shovels at the Cousin's Island site in Yarmouth are (l to r) Eric Sanders, contractor for the job; Frederick Allen of Maine Public Utilities Commission; William F. Wyman, president of the utility; and William B. Skelton, CMP board chairman.

Shortly before launching construction at the new site, CMP had made final adjustments on a new 30,000-kw unit at its Mason Station in Wiscasset. The addition boosts capacity of the plant, largest in CMP's system, to 130,000-kw.

Interior Sets Its Policy on Foreign Bid Margin

Interior Department last week clarified its policy on accepting foreign bids on heavy electrical equipment under "Buy American" regulations. The policy definition will make it easier for foreign bidders to win contracts for equipment which their U. S. competitors plan to make in labor surplus areas than it has been recently.

Under the new Interior policy foreign bidders will win contracts for heavy electrical equipment if the landed duty-paid cost of their equipment is 12% or more below the lowest American bid provided the domestic firm plans to manufacture in a surplus labor area. If the American equipment is not to be made in a labor surplus area, the 6% differential will apply.

The standard was set in connection with the award by Interior last week of four contracts for transformers and circuit breakers to British, Italian, and Swiss firms for Bureau of Reclamation projects in Idaho, Minnesota, and Missouri.

ODM Okays $48 Million for Utility Write-offs

The Office of Defense Mobilization has certified about $48 million of new utility generating capacity totaling $78 million as eligible for rapid tax amortization.

Four companies are involved: Florida Power & Light Co can amortize 65% of its $28-million generation investment within five years; Texas Electric Service Co can do the same with its $11-million program; Niagara Mohawk Power Corp can write off 35% of a total of $9.3 million in five years; and Cleveland Electric Illuminating Co can strike 65% of $30 million.

In addition, ODM certified write-offs of 65% for these transmission system expenditures: Pennsylvania Power & Light Co, $2.9 million; Kentucky Power Co, $1.2 million; Kingsport Utilities, Inc, $907,000.

AERIAL LUG CLAMPED TO SPUN COPPER HOOD TO COMPLETE INSTALLATION
VENT SCREW SOLDERED OVER AFTER FILLING
TAPERED PIPE PLUG TIGHTENED BY ALLEN WRENCH INSERTED THROUGH VENT HOLE
SLOTTED STEM EXPANDED AGAINST HOOD BY TAPERED PIPE PLUG
SPUN COPPER HOOD
SOLDER HOLE
CONDUCTOR
FACTORY SOLDERSEAL

Permanent electrical connection is quickly, easily accomplished by installer using Allen wrench. Tapered pipe plug is screwed down into the stem, expanding the stem against the inside of the hood and making the connection.

THIS EXCLUSIVE* ANACONDA SOLDERSEALED POTHEAD

GIVES YOU A SOUNDER CONNECTION NOW —SIMPLIFIES RELOCATION LATER!

If you have gasket leak problems, now is the time to end them forever–with Anaconda Soldersealed Potheads. They have no gaskets. All connections are soldered.

And now–a new method of making cable connections in these potheads adds *two more advantages* that no other pothead can give you.

SOUNDER CONNECTIONS BECAUSE:

1. Mechanical support for the cable is permanently achieved immediately after stem is inserted in hood, thereby preventing misalignment of cable during wiping and filling operations.

2. Permanent electrical connection is achieved when the stem is inserted in the copper hood. Compound is prevented from flowing between the stem and hood during filling operation and from interfering with the electrical connection.

3. Less chance of faulty field connection. "Double-action" electrical connection is achieved by expanding the slotted stem against the inside of the copper hood and by the clamping action of aerial lug on the outside of the hood.

EASIER RELOCATION BECAUSE:

1. Connection between the stem and the copper hood can be broken by merely loosening the tapered pipe plug and withdrawing the cable.

2. Pothead can be salvaged without repairs on the copper hood since the initial connection is made without crushing the hood.

Anaconda Soldersealed Potheads are available in 1/c type up to 46kv for indoor or outdoor service–stocked, ready for delivery. Now get both your power cable and Soldersealed Potheads from Anaconda. The Man from Anaconda is ready to give you all the details. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

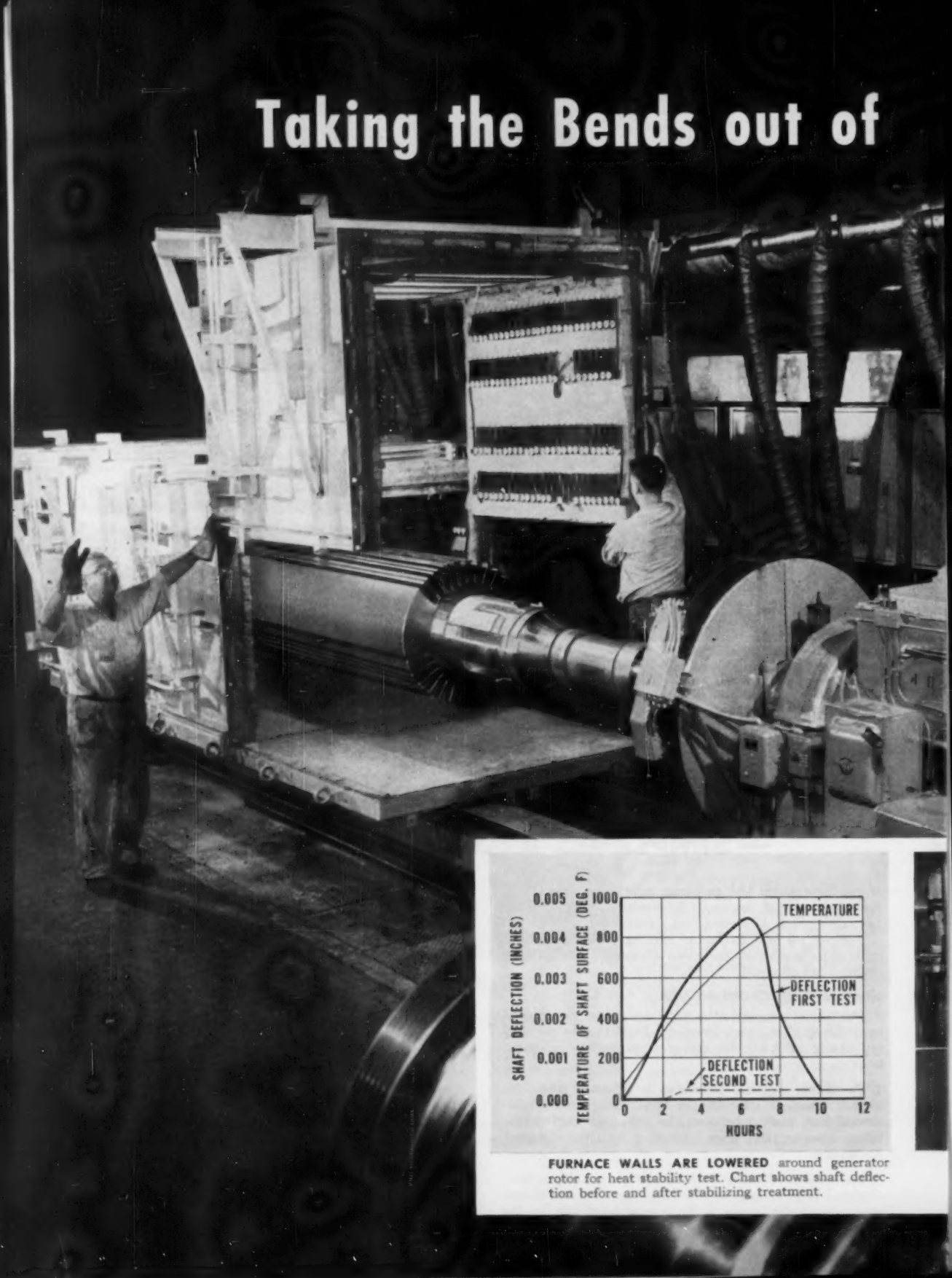
*Pat. applied for

SEE THE MAN FROM

ANACONDA®

ABOUT YOUR SOLDERSEALED POTHEADS

Taking the Bends out of



FURNACE WALLS ARE LOWERED around generator rotor for heat stability test. Chart shows shaft deflection before and after stabilizing treatment.

Turbine and Generator Rotors

General Electric's careful manufacturing procedures help assure thermal stability before units leave the factory

Large steam turbine-generators must be practically free of vibration in operation if long life and minimum maintenance are to be achieved. Continued smooth operation requires both good design and extreme care during manufacture and assembly of rotor components.

AN ESSENTIAL REQUIREMENT in manufacturing is to obtain maximum thermal stability of the rotors. A thermally unstable rotor will bend slightly when the turbine-generator is at operating temperature, introducing mechanical unbalance which may cause the unit to vibrate objectionably at running speed.

This type of instability may be caused by several factors. These include nonhomogeneity of the forging material and machining strains or distortion of the surface crystals during machining operations. And in generators, rotors may have slight variations in dimensions of slots and windings or dissymmetries in the ventilation circuit.

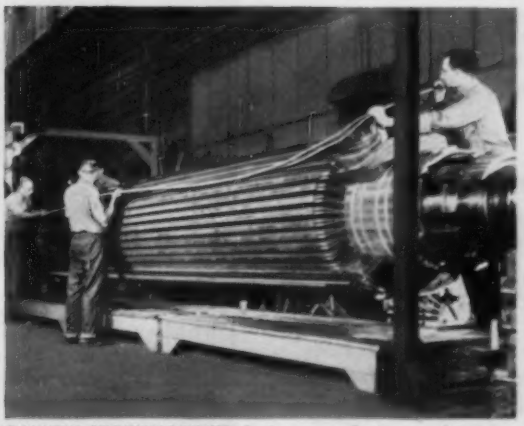
General Electric has developed standard manufacturing procedures to help make sure that rotors are thermally stable before leaving the factory.

EARLY IN THE MANUFACTURING CYCLE turbine rotors which will be subjected to high operating temperatures, and large high-speed generator rotors are tested for thermal stability. If necessary, they are either "cured" in a heat lathe or rejected. In addition, careful manufacture, close inspections during various stages of rotor assembly, and factory tests at operating speed gives assurance of maximum thermal stability—a feature you can depend on with General Electric turbine-generators. If you would like more information on this subject, contact your nearest G-E Apparatus Sales Office or write for bulletin GER-767, "Balancing Turbine-Generator Rotors." General Electric Company, Schenectady 5, N. Y. 254-30

Progress Is Our Most Important Product

GENERAL ELECTRIC

ALTERNATE SLOT MILLING of generator rotor compensates for minor slot variations—provides symmetry.



CAREFUL WORKMANSHIP during manufacture and assembly of rotor windings helps equalize heat and temperature distribution, which contributes to thermal stability.

PRECISION BALANCE of generator rotors helps assure vibration-free operation.

two of each three are strung on O-B

Miles, that is! Two-thirds of the extra-high voltage circuit-miles in North America are strung on Ohio Brass Insulators. *Every* extra-high voltage project in North America has chosen O-B for all or part of the suspension insulator requirement. This, we think, is excellent proof of the industry's faith in the quality and performance of Ohio Brass products.

Since the EHV transmission requirements that call for the best insulators apply equally to the hardware, it is worthwhile to point out that only Ohio Brass Company maintains an organization which designs, produces, tests, and evaluates the insulator-hardware combinations needed for EHV transmission.

Constant use of these research facilities keeps O-B attuned to the needs and problems of the electric utility industry. It also keeps O-B products at the quality level that encouraged their selection for two-thirds of the EHV circuit-miles in North America!

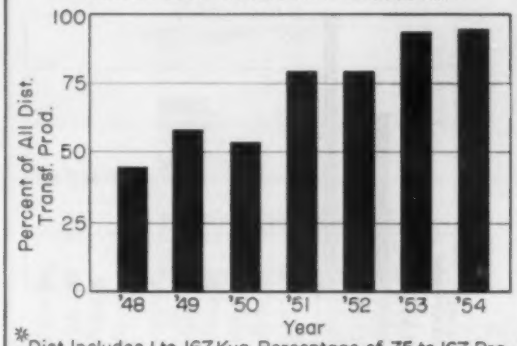
OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

Deadends on 330-kv construction. Insulators, yokes, and control rings furnished by Ohio Brass Company.

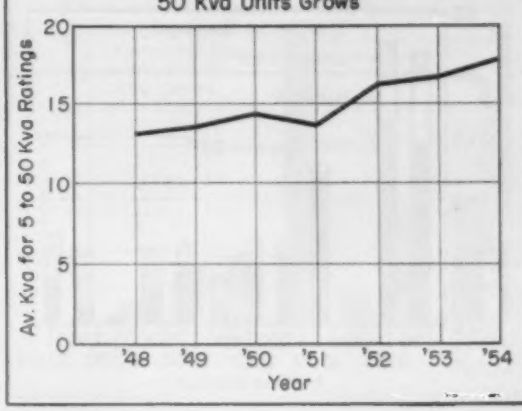
4547-H

FIG. 1 - 5 to 50-Kva Units Account for Bulk of Distribution Transformer Production*



*Dist. Includes 1 to 167 Kva. Percentage of 75 to 167 Production Has Remained Essentially Constant Over This Period.

FIG. 2 - Average Kva Rating of All 5 to 50 Kva Units Grows



Transformers Reflect Load Gains

SYSTEM ENGINEERING
Operation

Sizes and designs, manufacturer's records show, reflect power usage gains, and engineering practice favors big single units

JOHN H. CHILES JR. Manager, Transformer Engineering, Westinghouse Electric Corp, Sharon, Pa.

Transformer production today reflects changes in electric power use. Transformer size and design, surveys show, have altered as electric power usage increased. Survey figures indicate the direction of growth and the reasoning behind new designs and application practices. Here are some trends apparent in Westinghouse transformer production statistics.

Increased use of electricity in the home accelerated the switch to larger kva ratings of distribution transformers. In general, larger units cost less per kva initially, and their losses and maintenance cost less. In 1948 approximately 40% of the distribution transformers produced in the one through 167-kva ratings were in the range of 5 to 50 kva; in 1954, more than 90% fell in this range. As the percentage of 75 through 167 kva remained essentially constant, the trend is obviously toward an increase in average rating in the smaller sizes. This trend is borne out by figures showing that the average kva rating in the range from 5 through 50 kva has increased from 13 kva in 1948 to 18 kva in 1954, an increase of around 40%.

The higher kva distribution ratings resulted from the trend to higher primary voltage with its improved regulation and reduced distribution cost. During this period production of transformers in the 12,000-v rating and above remained essentially constant at 3 to 4% of the total. On the other hand, the 7,200 and 7,620-v ratings increased from 35 to 53% of the total. As accompanying curves show, this latter change was at the expense of the 4,800-v rating which dropped from a high of 25 to about 12 or 13% last year, and of the 2,400-v rating which

FIG. 3 - Primary Voltage Trend is Up (10 Through 50 Kva Only)

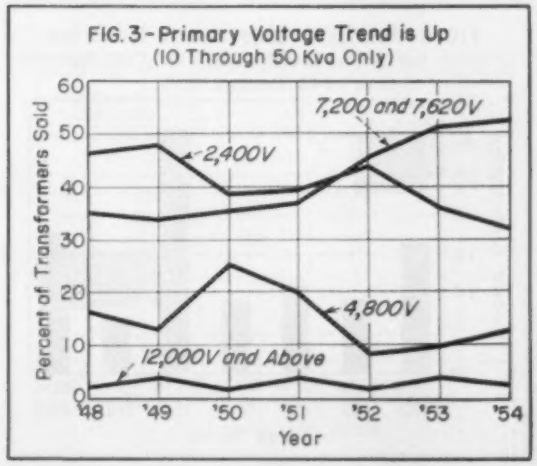
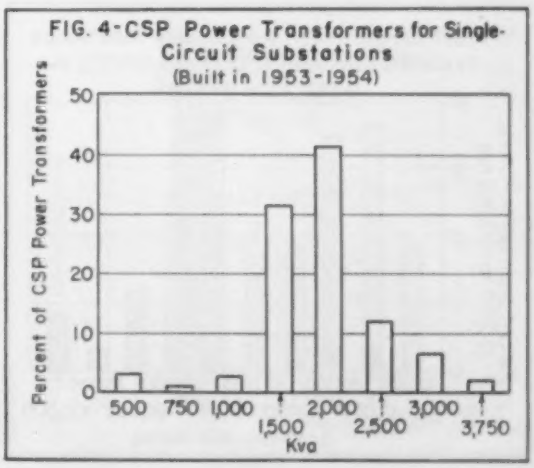


FIG. 4 - CSP Power Transformers for Single-Circuit Substations (Built in 1953-1954)



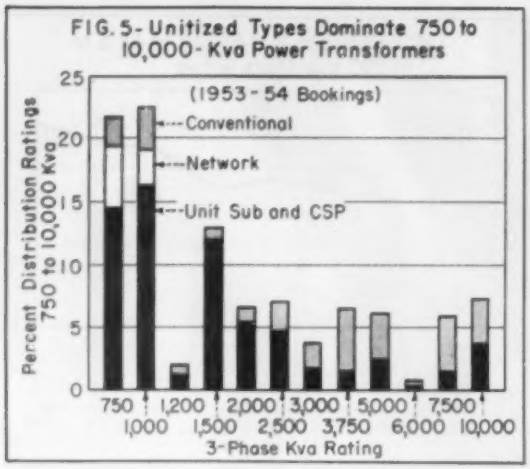


FIG. 5- Unitized Types Dominate 750 to 10,000-Kva Power Transformers

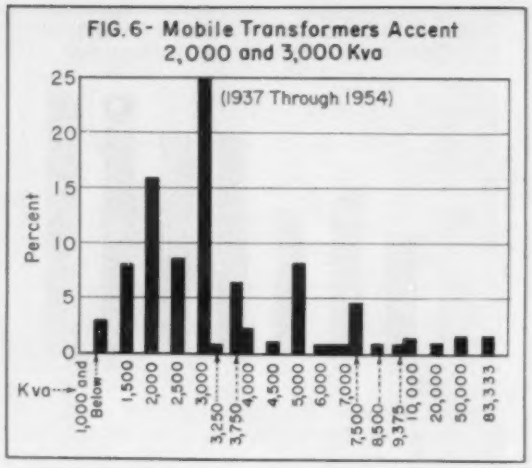


FIG. 6- Mobile Transformers Accent 2,000 and 3,000 Kva

dropped from about 47 to about 32% of the total transformers sold.

The use of sealed dry-type transformers has increased rapidly. Inherently fireproof and moisture-proof and needing little maintenance, they are being applied in increasing numbers in mines, as part of generating station auxiliaries' power supply, and in similar situations.

Dry-Type Units Gaining

Dry-type transformers are much preferred now to askarel-filled units and are being applied in power centers and unit substations in a ratio ranging from 70 to 90% of the total production of dry and askarel types. The askarel type was in most demand in 1949 for network transformers, when the production ratio was 90% askarel to 10% dry type. In 1954 the production of each type was around 50%.

According to 1953-54 figures for transformers in single-circuit CSP unit substations, 31% were 1,500-kva units, 41% 2,000-kva units, and the remaining 28% covered ratings 500 through 3,750 kva. It is noteworthy that 55% of the units made today are CSP in the range covered by CSP ratings.

The rapid increase in unitized equipment over the past few years is well known in the industry. What may not be so fully appreciated is the fact that so many of the 3-phase transformers, rated 750 through 10,000 kva, are in unitized equipment. They are applied as network transformers, unit substations, CSP power transformers, and power centers. In 1953-54 57% of the units produced in this range were of 750, 1,000, and 1,500-kva rating, these three kva classes representing 50% of the total units in unitized equipment. Fig 5 indicates the high acceptance of unitized or packaged equipment. Such equipment has a lower installation cost, requires less expediting, and has a reduced utility or industrial engineering cost.

Mobile Substations Up

Mobile substations, introduced for emergency service in the event of a transformer failure, seem now to find their major use in by-passing transformers for maintenance scheduled in the normal work week, rather than for weekend outages. Between 1937 and 1954, about 25% of these units were in the 3,000-kva rating, about 17% in the 2,000-kva rating, the remainder ranging from the smallest rating up through large railway mobile units to 50,000 kva, 3-phase, and 83,333 kva, single-phase.

In 1953-54 the 15, 20, and 50-Mva

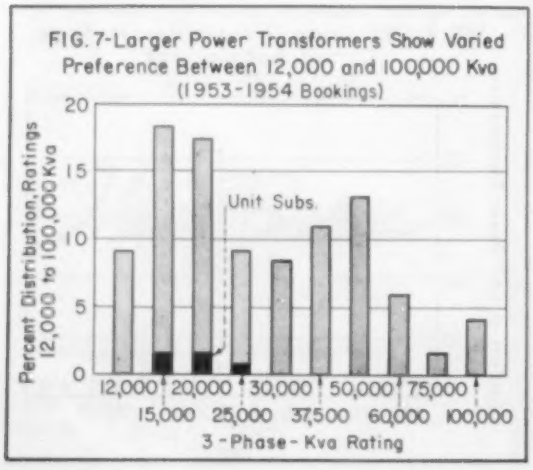


FIG. 7-Larger Power Transformers Show Varied Preference Between 12,000 and 100,000 Kva

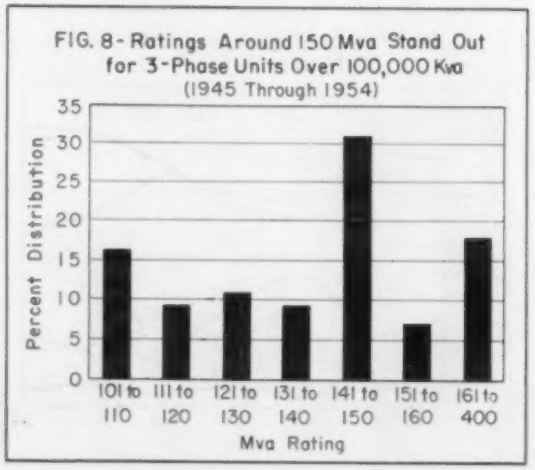
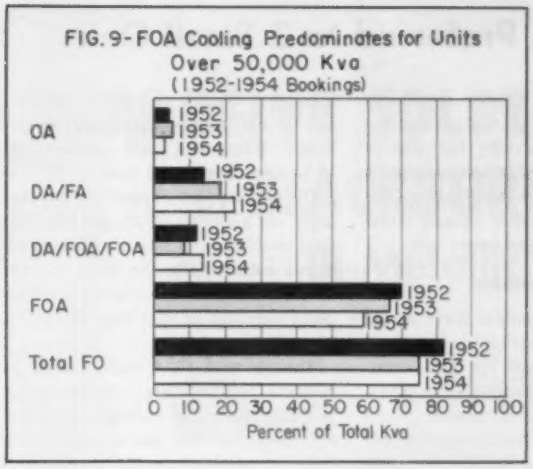


FIG. 8- Ratings Around 150 Mva Stand Out for 3-Phase Units Over 100,000 Kva



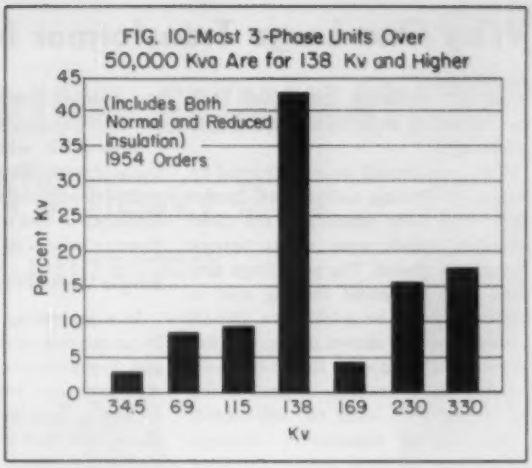


FIG. 10-Most 3-Phase Units Over 50,000 Kva Are for 138 Kv and Higher
(Includes Both Normal and Reduced Insulation)
1954 Orders
Percent Kv
0 5 10 15 20 25 30 35 40 45
34.5 69 115 138 169 230 330
Kv

ratings predominated in the percentage distribution of 3-phase power transformers in the 12 through 100-Mva range. As kva size mounted, other ratings generally showed a lesser percentage. Less than ten years ago, this company built the industry's first transformer over 100 Mva. This year two 400-Mva, 330-kv transformers were delivered, units rated at least one-third larger than any previous transformers. In addition, 220-Mva generating station transformers have been shipped, 315-Mva generating station units are being manufactured, and 360-Mva transformers are designed.

Ratings Up Weight Down

It might be noted as a benchmark of progress that a 45-Mva unit (forced-air cooling), built some 20 years ago, weighed 590,000 lb, while each of the 400-Mva, 330-kv giants is only about 10,000 lb heavier. This relatively lighter weight results from the use of form-fit design, Hipersil steel, reduced insulation, and forced-air cooling. The 315 and 360-Mva units will be shipped upright in their own one-piece tanks, a practice with all larger transformers for the past several years where railroad clearances will permit. All these giants have had impulse tests as well as their normal low-frequency tests.

3-Phase Units Popular

In 1953-54, 87% of all bank ratings 50 Mva and above were 3 phase, and only 13% on a bank basis were single phase. Of the larger units, 20% are autotransformers, doubtless because of their greater efficiency and lower first cost, and 30 to 40% have three or more windings. These attributes add to the design complexity for meeting impedance requirements and the impulse distribution necessary to pass rigid dielectric tests.

The choice of types of cooling for units 50 Mva and above sold between 1952 and 1954 was only about 5% self-cooled, about 19% with a self-cooled and forced-air rating, and about 10% with one stage of self-cooling and two stages of forced-oil cooling. The remaining 65% were forced oil with forced-air cooling (FOA). Over this period about 75% of the units above 50 Mva used forced-oil cooling.

Full Insulation Uncommon

For ratings 50 through 400 Mva, 3 phase, the percentage of the total kva for each system voltage is shown for 1954 in Fig 10. By far the greatest percentage is for 138-kv systems. Fig 11 shows that only 26% of the units in the range 550-kv BIL and above

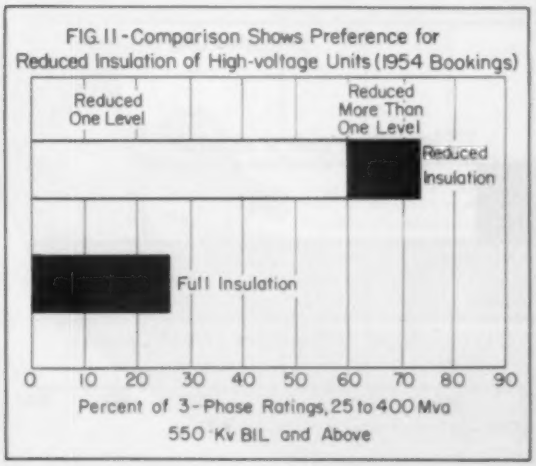


FIG. 11-Comparison Shows Preference for Reduced Insulation of High-voltage Units (1954 Bookings)
Reduced One Level
Reduced More Than One Level
Reduced Insulation
Full Insulation
0 10 20 30 40 50 60 70 80 90
Percent of 3-Phase Ratings, 25 to 400 Mva
550 Kv BIL and Above

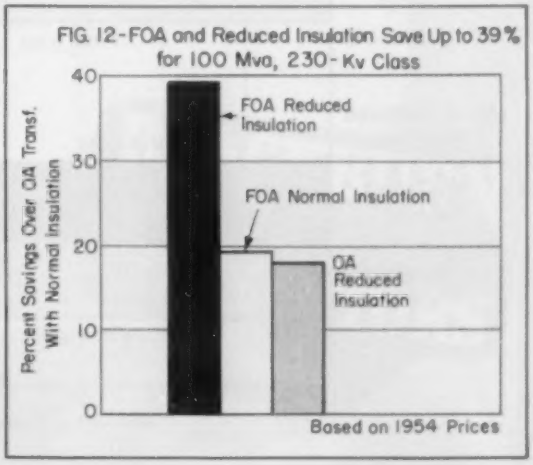


FIG. 12-FOA and Reduced Insulation Save Up to 39% for 100 Mva, 230-Kv Class
Percent Savings Over OA Transf. With Normal Insulation
0 10 20 30 40
FOA Reduced Insulation
FOA Normal Insulation
OA Reduced Insulation
Based on 1954 Prices

Why One Large Transformer Is Preferred to 2 Small Ones

used full insulation, the other 74% having one or more levels reduction in insulation.

The large capital savings afforded by forced-oil cooling and reduced-insulation levels have accelerated the trend to such transformers where system conditions permit. The percentage savings with forced-oil cooling over a self-cooled unit on a 100-Mva, 230-kv transformer are shown in Fig 12. Reduced insulation and forced-oil-to-air cooling make available a total saving of almost 40% over the self-cooled, fully insulated transformer. General acceptance of these two methods of reducing capital investment is understandable.

Yet these reduced capital investments cannot be considered direct savings from an engineering viewpoint. It is essential that the higher loss values for an FOA unit be evaluated as well as the somewhat compensating lower loss values for reduced insulation levels and reduced insulation at the neutral where system conditions permit their use.

It is often asked why the size of transformers has increased so rapidly and why advantage is not taken of the flexibility of two smaller 3-phase transformers instead of one larger unit.

Single Units Preferable

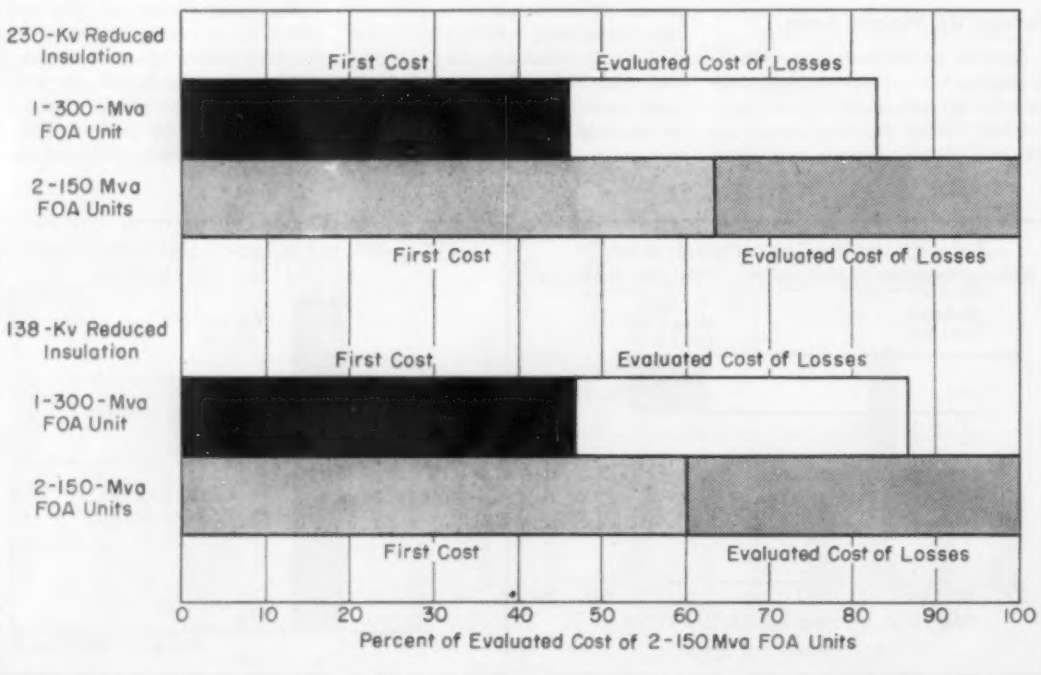
In a generating station, there would be an increase in installation, handling, and connection costs for two units. As the service availability of a transformer is relatively continuous compared with that of the turbogenerator and boiler, there is usually no engineering reason for not using a single unit, particularly where the generating unit is a small percentage of system kva.

One of the basic reasons for larger single units is illustrated in Fig 13 which shows the savings by the use of a single 300-Mva transformer instead of two 150-Mva units. The comparison includes 138 and 230-kv reduced-insulation classes and shows percentage savings in basic cost and evaluated losses. Even with such a wide-range of loss evaluations as iron at $225 to $500 per kw and copper correspondingly at $300 to $325 per kw, the total evaluation of first cost and losses shows substantially the same savings, ranging between 14 and 17%, from using one unit of 300 Mva instead of two 150-Mva units.

Savings with FOA and reduced insulation add to these. In the larger power transformer ratings, these savings over the last six to eight years have accumulated to the point where kva can be put on the system at less than costs of ten years or so ago.

Trends in the use of transformers arise from many factors, ranging from engineering improvements to user preferences. Although figures cannot always be correlated with specific changes in design or practice, the overriding influence of increasing use of power is clearly evident.

FIG. 13 - Comparison Shows Lower Evaluated Costs for 300-Mva Station Transformers



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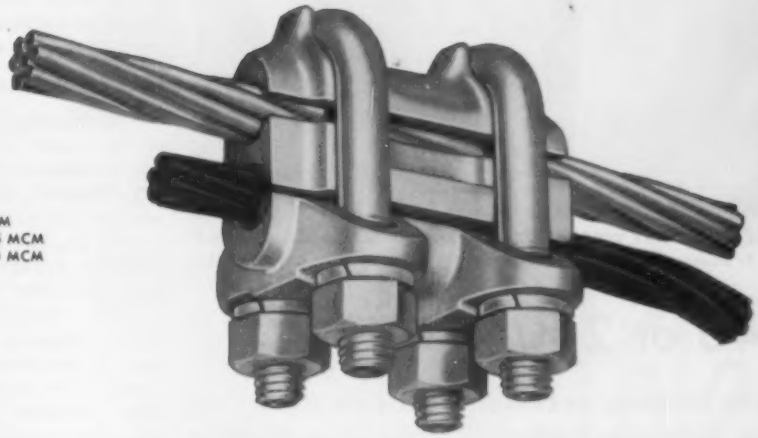
in BLACKBURN'S Heavy Duty Bi-Metallic Connectors

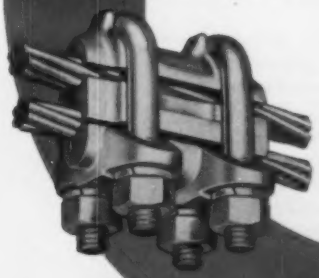


Sizes available to accommodate ACSR 2—336.4 MCM Alum. 1 Str.—397.5 MCM Copper 4 Str.—250 MCM

PRESSURE SEALED, SHRINK-FIT COPPER LINER SEALS OUT AIR AND MOISTURE—PERMANENTLY!

- Manufactured under controlled atmospheric conditions!
- Eliminating corrosive solders and fluxes between copper liner and aluminum casting insures permanent high conductivity.
- Factory applied protective coating prevents oxidation of contact spacer grooves during transit and storage.
- Castings are high-strength, heat-treated alloy with exceptionally heavy cross sections.
- Clamping forces are distributed over extra long surfaces—contour of grooves protects conductor.
- All Aluminum hardware is alumilited to prevent seizing—bolt features rolled threads of greater strength.

Sizes available to accommodate ACSR 2—336.4 MCM Alum. 1 Str.—397.5 MCM



HEAVY DUTY ALL ALUMINUM CONNECTORS

Also available without copper liner for Aluminum to Aluminum. Coefficient of expansion same as conductor. Same high standard of material and construction as above connector.

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PARTICIPANTS IN SECONDARY VOLTAGE DISCUSSION were D. K. Blake, left, General Electric; R. F. Lawrence, Westinghouse; and W. R. Bullard, Ebasco Services

120/240 or 240/480V?

Conflicting viewpoints on change to latter are brought out at Texas Power Distribution Conference. Other topics discussed

Secondary system design dominated the program of the eighth annual Power Distribution Conference, Oct. 24-26, at Austin, Texas. But distribution problems in high-load density areas, application of series capacitors, substation design, transformer standards, and improved insulations for power cables figured prominently in discussions.

D. K. Blake, General Electric Co, and W. R. Bullard, Ebasco Services, took opposing views on whether the industry should change from 120/240 to 240/480 v for secondary systems. Bullard reported studies that showed economic savings so great, he said, that the industry should move toward gradual transition to the higher voltage.

Blake urged that more comprehensive economic studies be made before such a drastic step is taken. He said his studies indicated savings approximating 5%. This, he said, is not sufficient to justify the change in view of the question of safety to customers and the problem of serving 120/240-v appliances now in service.

R. F. Lawrence, Westinghouse Electric Corp, said studies made by his company indicated savings of 30% for the 265/460Y-v system and nearly as much for 240/480 v. He cited the transition now underway in commercial areas but recognized the difficulty with regard to appliances. However, he said, the change to higher secondary voltage would speed the trend toward electrical living.

Most economical secondary arrangements, according to a study by Chase Hutchinson and A. S. Anderson, Ebasco, ranged from two spans of 1/0 aluminum conductor each way from the transformer for 20 customers of 2½-kva demand each to one span of 477-MCM aluminum each way from the transformer for eight customers having a demand of 20 kva each.

B. B. Mohr, Oklahoma Gas & Electric Co, reported that similar studies are being made by his company.

To get more out of transformer dollars, Dallas Power & Light Co has used business machines and kilowatthour information to determine transformer loads, replacement schedules, and sizes of new transformers to be installed. J. P. Barron said breakers on CSP transformers have been set up so they do not trip until the load reaches 135% at 50C. This gives enough time to replace units between the time the red light comes on and the breaker trips.

Low-voltage capacitors, 240 v, in series in distribution transformer primary neutrals have deferred secondary and transformer replacements, said A. R. Milliken, in reporting on Public Service Co of Oklahoma experiences. Failure rate of capacitor units has been more than anticipated, but experience indicates that this can be reduced.

Nomenclature a Handicap

Nomenclature is proving to be one of the biggest difficulties in transformer standardization, J. B. Hodtum, Allis-Chalmers Manufacturing Co, told the conference. The nomenclature of the Edison Electric Institute Preferred Voltage Committee is the reverse of that used by the EEI-NEMA Transformer Committee. These differences are confusing to those in the industry.

Ability to expand existing substations, substation appearance, space availability, permissible noise in the area, and cost are the chief factors determining substation design, Miles Maxwell, Westinghouse, asserted. He illustrated steps being taken to meet conditions in different areas.

Butyl rubber is outstanding in its electrical properties whether it is wet or dry and is rapidly gaining acceptance as a high-voltage cable insulation, declared S. J. Rosch, Anaconda Wire & Cable Co. Polyethylene is also getting greater acceptance, he said.

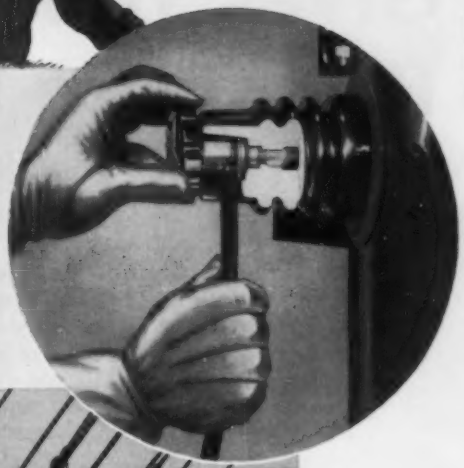
Canadian, Swiss Firms Make Cooperation Pact

An agreement for cooperation in the professional engineering field on an international scale has been reached by Sandwell & Company, Ltd., Vancouver, B.C. consulting engineers and Electro-Watt Electrical and Industrial Management Co, Ltd, of Zurich, Switzerland.

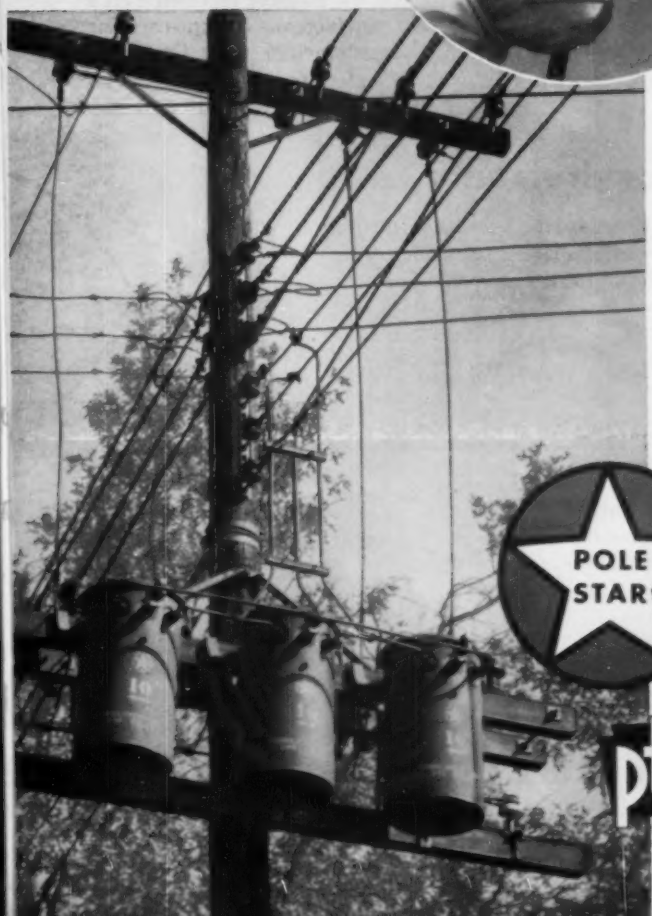
P. R. Sandwell announced in Vancouver that the Swiss firm will place at the disposal of his Canadian company its extensive engineering experience in the electrical power industry while Sandwell will provide the experience in the forestry products industry.

"Hold it, George!

You don't need all that stuff to make a line connection to a Pole Star"



The Basic Impulse Level of all Pole Star bushings is co-ordinated with the transformer windings. When the transformer is subjected to a voltage surge above the BIL of the bushing, the bushing will flashover on the outside. A separate, completely co-ordinated bushing is available for each voltage class.



If it's a high voltage sidewall bushing, George won't even need a wrench to make a line connection. He can simply insert the incoming cable through the side opening and turn the corrugated easy-to-grip handle. This tightens the pressure block against the cable in a vise-like grip. Most bushings are constructed so that leads can be brought into them from two points 180° apart. The generous-sized handle is constructed of a specially formulated, high dielectric strength, high impact strength, low power factor material. The handle will not break to expose live parts nor chip to cut a lineman's glove.

And George can throw away that X-ray gadget, too. He won't need it because he'll be able to see what he's doing while making line connections up there.

High voltage cover bushings and low voltage sidewall bushings have solderless connectors which are tightened with only a standard wrench to hold line leads securely. All Pole Star bushing terminals are suitable for copper or aluminum cable.

Pennsylvania Transformer Company

A McGraw Electric Company Division

CANONSBURG • PENNSYLVANIA

Pole Star transformers are available in sizes 3 Kva through 500 Kva and in voltages from 480 through 67,000 volts.

Get More for Your

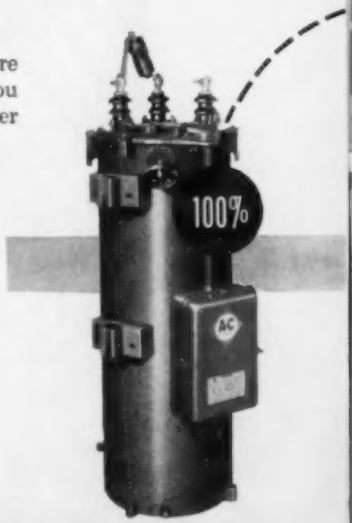
Vari-Amp Feature Gives You 5 Ratings in 1

No Need to Change Regulators as Loads Grow when Allis-Chalmers distribution regulators are on your system. The *Vari-Amp* feature lets you step up ratings as much as 60% by reducing the range of regulation.

Here's how it's done: Reduce the range of regulation on a step-type regulator and you can increase current-carrying capacity. The *Vari-Amp* feature provides stops that limit range of regulation in five 1¼% steps from ±10% to ±5%.

Fits Varying Requirements

You get considerable flexibility because the *Vari-Amp* feature permits using unequal ranges of regulation. Set what you need — for example, 6¼% raise at 135% current, 10% lower at 100% current.



No Extra Cost

Best of all, you get this convenient feature on Allis-Chalmers distribution regulators at no increase in cost. You get more uses for each regulator.

Get complete information on how the *Vari-Amp* feature can help you stretch your regulation dollar. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4811

Originators of 5/8% Step Regulation

ALLIS-

Regulation Dollar

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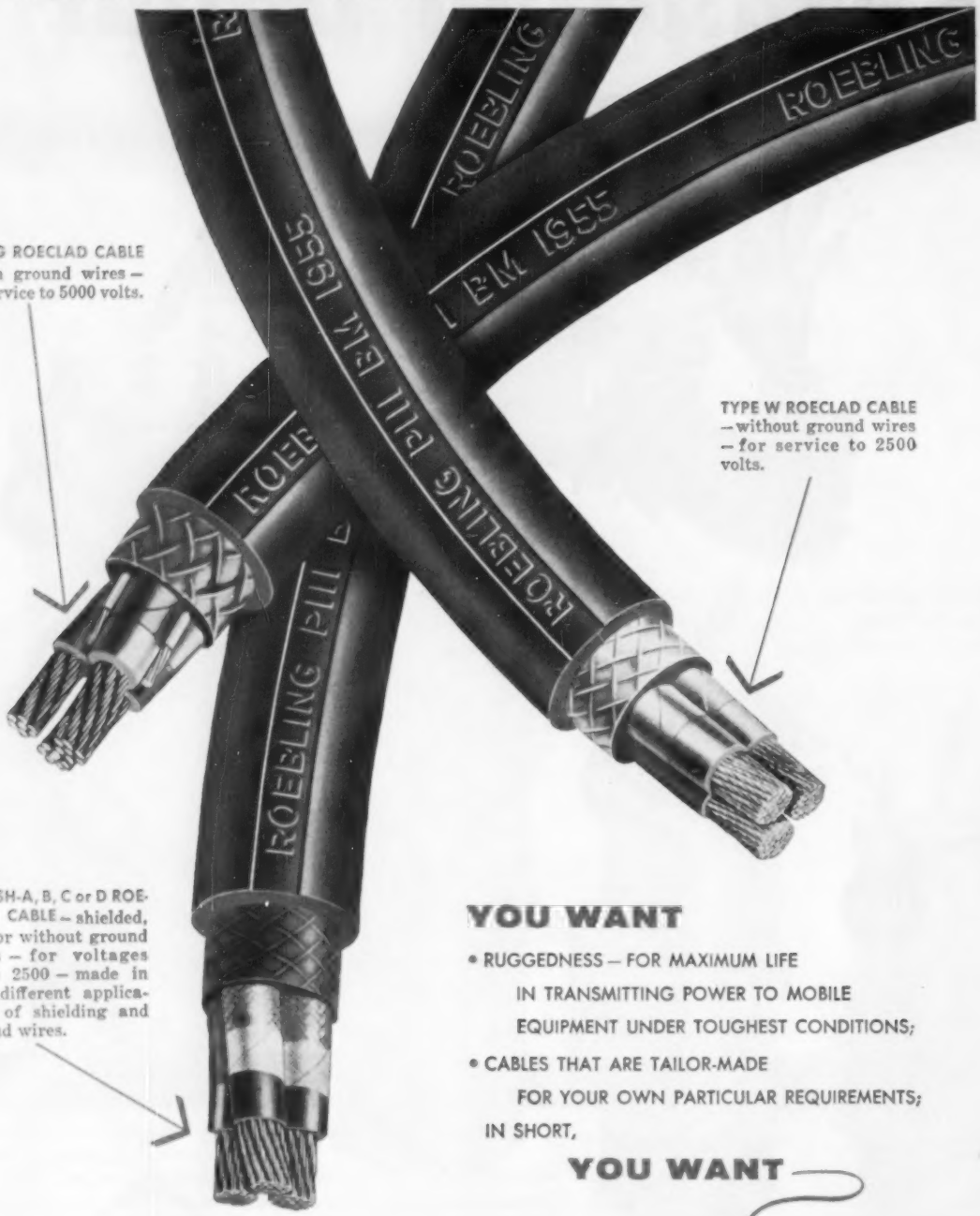
ROECLAD PORTABLE POWER CABLES



TYPE G ROECLAD CABLE – with ground wires – for service to 5000 volts.

TYPE W ROECLAD CABLE – without ground wires – for service to 2500 volts.

TYPE SH-A, B, C or D ROECLAD CABLE – shielded, with or without ground wires – for voltages above 2500 – made in four different applications of shielding and ground wires.

YOU WANT

- RUGGEDNESS – FOR MAXIMUM LIFE IN TRANSMITTING POWER TO MOBILE EQUIPMENT UNDER TOUGHEST CONDITIONS;
- CABLES THAT ARE TAILOR-MADE FOR YOUR OWN PARTICULAR REQUIREMENTS;

IN SHORT,

YOU WANT

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 2353 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 530 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

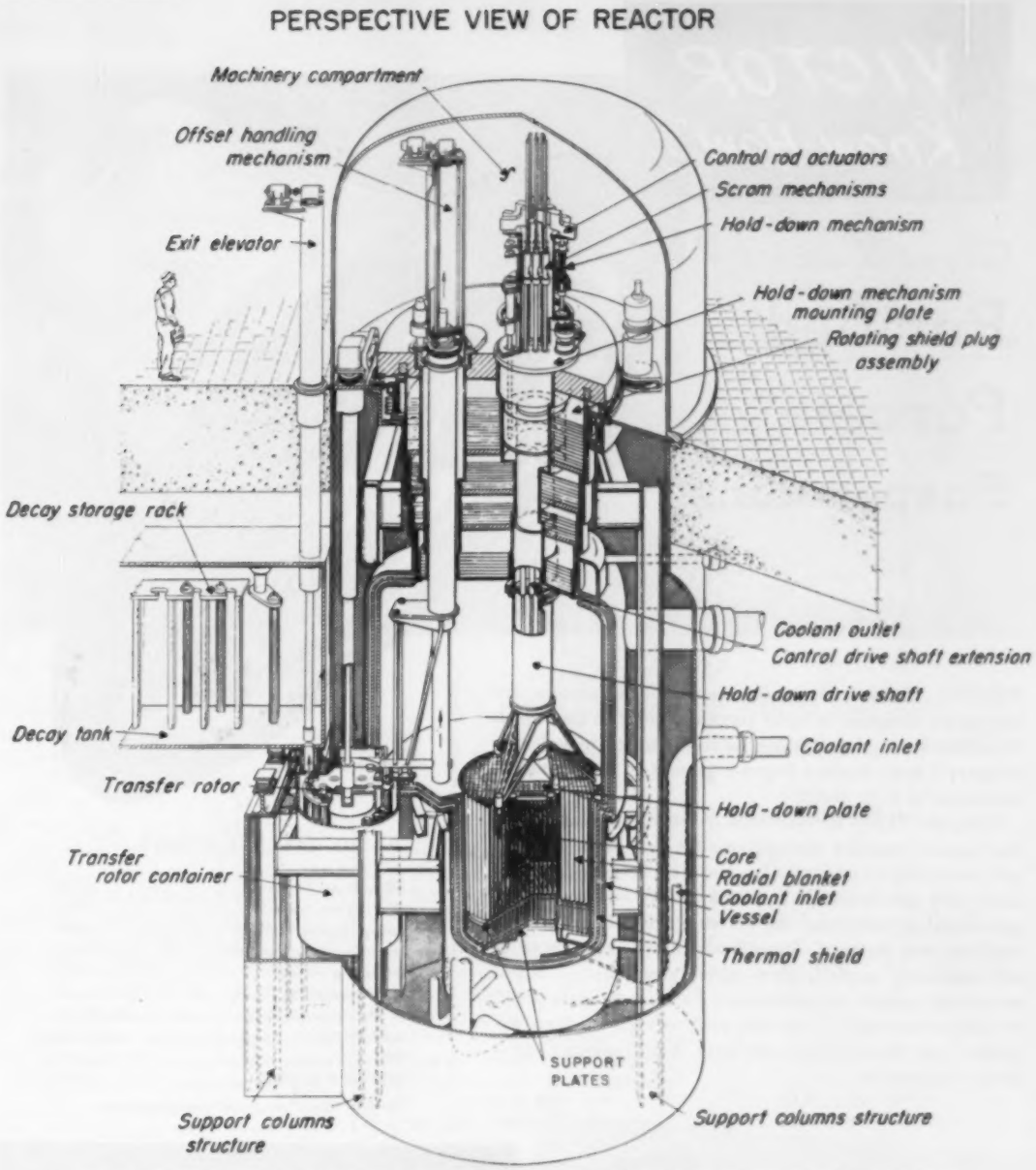


FIG 1—REACTOR, WHICH HAS GREAT COMMERCIAL POTENTIALITIES, WILL PRODUCE 300 MW OF HEAT

APDA Plans Fast Breeder Reactor

A. AMOROSI, Technical Director, Atomic Power Development Associates, Inc

A. P. DONNEL, General Manager, Atomic Power Development Associates, Inc

H. A. WAGNER, Assistant Manager of Engineering, Detroit Edison Co

A liquid metal-cooled fast neutron breeder reactor, developed by Atomic Power Development Associates, is to be the key component in a 100-Mw atomic power plant proposed* and accepted as part of the AEC power demonstration reactor program.

Significance of the selection of such a reactor is the fact that reactors of this type have a real opportunity of becoming commercially justifiable. Moreover, breeder reactors appear to be indispensible to any large atomic power industry.

(*Continued on page* 27)

* The proposal to build a larger breeder reactor power plant was submitted to AEC in March 1954 by a group of power companies including: Central Hudson Gas & Electric Corp, Cincinnati Gas & Electric Co, Consumers Power Co, Delaware Power & Light Co, Detroit Edison Co, Long Island Lighting Co, Philadelphia Electric Co, Rochester Gas & Electric Corp, and Toledo Edison Co.

VICTOR "Know-How..."

Gives You Purified Porcelain Suspensions...

America's Finest

VICTOR NO. 924
(EEI-NEMA TDJ-52-5)
25,000 LB. SUSPENSION
INSULATOR

VICTOR *Purified* Porcelain suspension insulators are laboratory designed to make them the finest in their field. VICTOR'S complete testing facilities, which include the industry's most modern impulse generator, certify to the soundness of their design.

Take the 25,000 lb. unit shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt, built to the most rigid specifications, are thick, husky and double-dip galvanized to withstand the severe service for which this insulator was designed. Scientifically fitted glaze, properly and uniformly applied, gives added strength . . . added protection against contamination. Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. You just can't buy a better suspension!

SPECIFICATIONS

60-cycle dry flashover	80 KV
60-cycle wet flashover	50 KV
Positive impulse flashover*	125 KV
Negative impulse flashover*	130 KV
Dry arcing distance	7¾"
Leakage distance	11"
M and E strength	25,000 lbs.
Impact rating	60 in. lbs.
RNI	50 Microvolts
1000 KC at applied	10 KV

*Crest KV, 1½ x 40 microsecond wave Critical Value.

NEWS FROM VICTOR

These two booklets—"The Story of Victor" and Bulletin No. 4—contain a wealth of insulator information that has proved of tremendous interest to thousands of power men throughout the nation. If you do not have both in your files, ready for instant reference, send for them today.

SPECIFY VICTOR Purified Porcelain Suspensions!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

APDA Reactor

(*Continued from page* 25)

Features of the ADPA reactor are these:

1. It will operate initially on U-235 fuel, not plutonium, for reasons of safety, availability of materials, and lack of plutonium technology. However it may ultimately use plutonium produced by breeding.

2. Both reactor core and blanket will be cooled by liquid sodium. Heat will be transferred to an intermediate sodium potassium system and then to water and steam.

3. Heat exchanger isolates radioactive materials from steam generator and turbine generator.

4. Steam generator will be once-through type producing steam at 600 psi, 730F.

5. Steam turbine will be of conventional design.

6. Containment of the reactor is an airtight cylinder of 1½-in. steel which provides protection against possible unforeseen reactor excursions.

7. Operation at low temperatures further reduces dangers. Temperature rise of the sodium through the reactor is limited to 250F.

8. The plant, which will be in operation in late 1959 or 1960, will provide for increase in reactor output.

Operation of this plant, together with results from the Argonne National Laboratory's experimental breeder reactor No. 2, is expected to yield information that will permit either the use of plutonium in this reactor at some future time or the construction of a full-scale plutonium breeder.

This reactor produces about 300 Mw of heat. Its corresponding gross electrical output is 100 Mw. In size, the core, or critical mass, will be about 2.5 ft in diameter and 2.5 ft high, surrounded by a 2-ft blanket of depleted uranium. A perspective view of the reactor is shown in Fig 1.

Core design . . . The reactor core, Fig 2, is an assembly of partially enriched uranium alloy pins. Plutonium is produced in the reactor core and in the surrounding breeder blanket of depleted uranium rods. Insertion of boron-containing poison rods provides shim and safety control.

The core consists of numerous square fuel-element subassemblies arranged to approximate a right cylinder. These subassemblies contain the fuel

(*Continued on page* 30)

REACTOR ARRANGEMENT

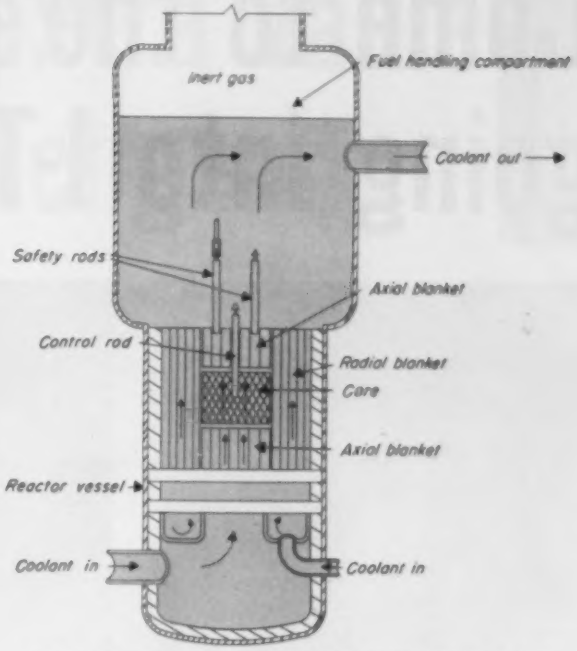
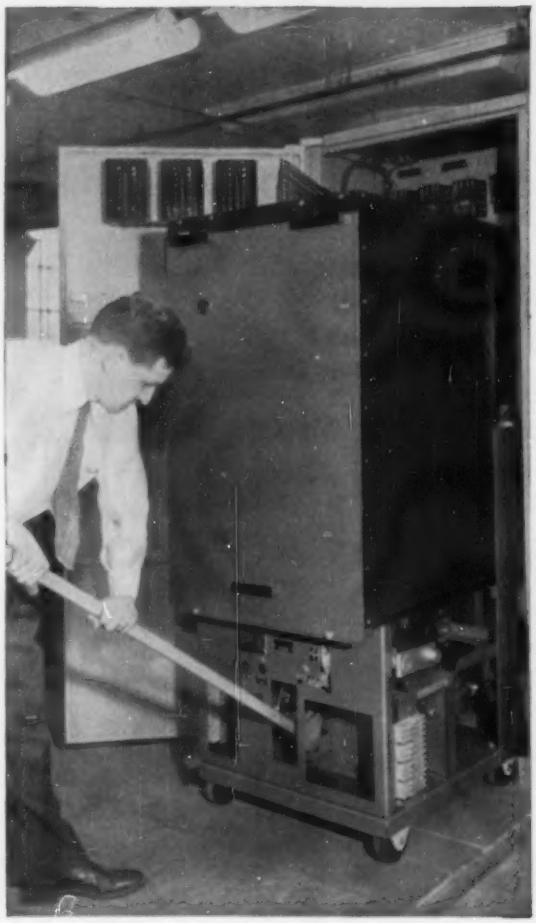


FIG 2—CORE IS AN ASSEMBLY OF URANIUM ALLOY PLATES

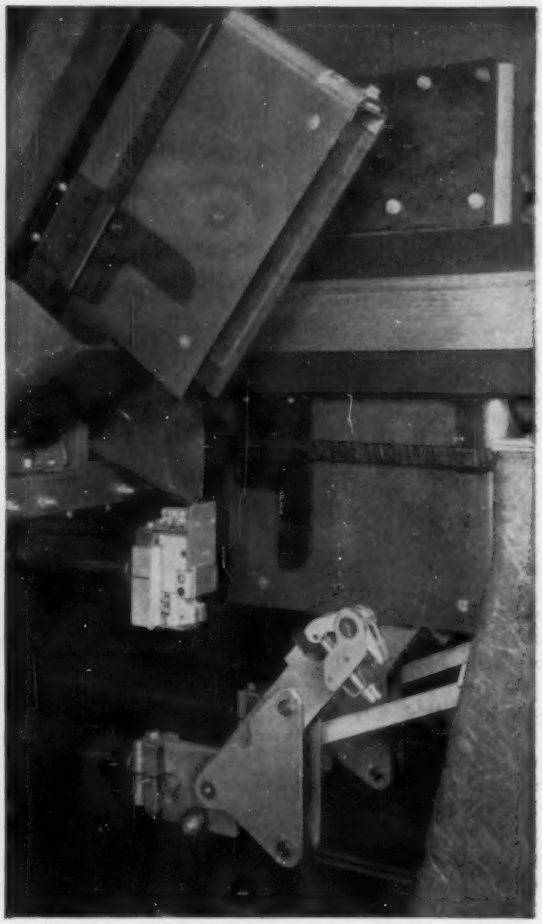
Table 1—Performance Data Tabulation

Plant Capacity	
Gross electric capacity	100 Mw
Net electric capacity	90 Mw
Turbine-generator rating	100 Mw
Reactor Specifications	
Power (heat)	300 Mw
Core diameter	30.5 in.
Core length	30.5 in.
Over-all height of reactor vessel	156 in.
Outside diameter of reactor vessel	120 in.
Thickness of reactor vessel	1-1½ in.
Core sodium flow rate	11.88 x 10^6 lb/hr
Sodium velocity	24.9 ft/sec
Liquid Metals and Steam Systems	
Net Thermal efficiency	30.0%
Sodium temperatures	
Leaving reactor	800 F
Entering reactor	550 F
Sodium Flow	13.2 x 10^6 lb/hr
NaK temperatures	
Entering boiler	750 F
Leaving boiler	500 F
NaK flow	16.1 x 10^6 lb/hr
Steam pressure	600 psia
Steam temperature	730 F
Steam Flow	1 x 10^6 lb/hr
Feedwater temperature	400 F

Come to the plant and going into I-T-E Metal-



1. Horizontal drawout design. Even heavy 15 kv circuit breakers, such as this one, roll out easily on permanently attached wheels. Breaker compartment is full-depth, one-piece welded frame, retains shape, permits lifting as a unit.

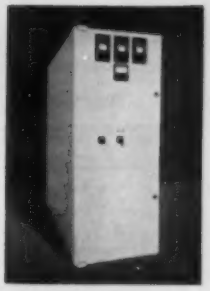


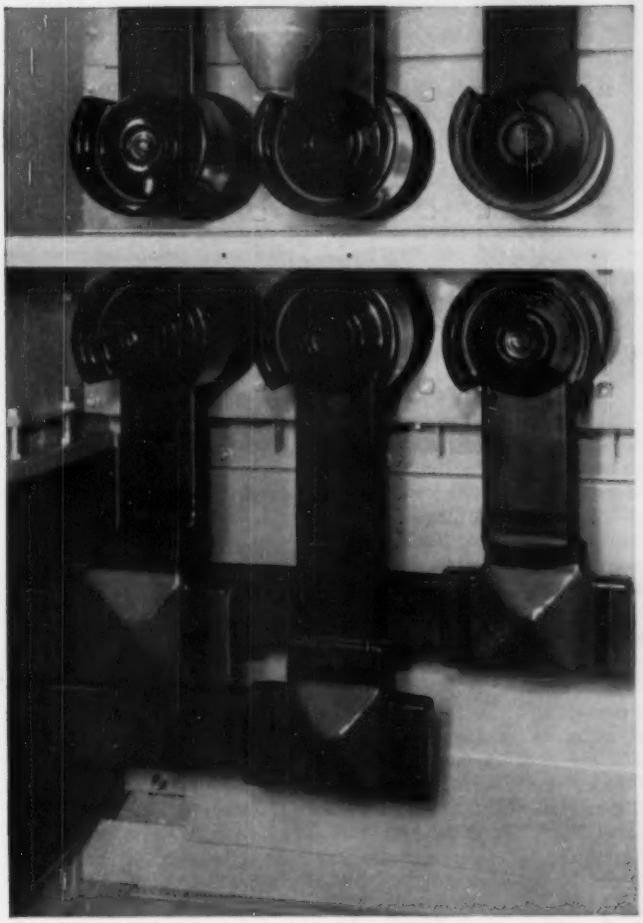
2. Positive arc interruption. On 15 kv breakers, double-coil, closed-iron magnetic blowout circuit draws arc rapidly into overhead quenching chute. Pivoting arc chutes, shown above, facilitate maintenance. Note sturdy contact assembly.

Discover in these pictures just a few of the extra-value, quality features in all I-T-E Metal-Clad Switchgear. They were taken right here in the I-T-E plant and show the equipment in process of manufacture.

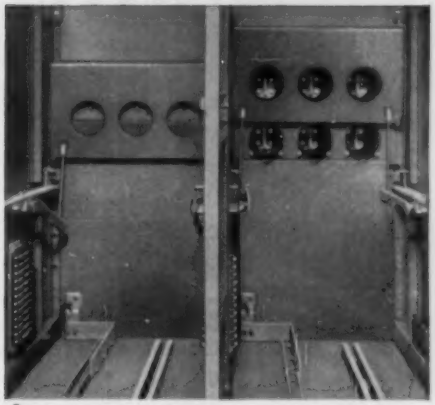
If you're planning new construction where you will need metal-clad switchgear, take a tip that can help you make the very most of your investment dollar: Visit the I-T-E plant here in Philadelphia. See the quality features actually being built into the equipment—quality that keeps I-T-E Switchgear performing more safely and dependably all the years it serves you. See the scenes shown on these pages, plus dozens more like them. See the extra value in I-T-E Switchgear that you won't find in any other

see the extra value Clad Switchgear





3. Bus rigidly braced, heavily insulated. View into rear of 15 kv compartment shows porcelain disconnect bushings and bus supports which insulate and hold the bus in alignment during short circuit stresses. Steel paneling throughout forms isolated compartments.



4. Superior isolation of compartments. Gravity-type shutters, shown closed at left and blocked open at right, isolate primary terminals from breaker compartment.

5. Fine, durable finish. All panels and doors are sanded, bonderized and cleaned with spirits, then painted with three coats of enamel—baked on and rubbed down.

make. I-T-E Metal-Clad Switchgear is available in ratings through 13.8 kv, 500 mva.

For details, contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th and Hamilton Sts., Philadelphia 30, Pa.

I-T-E

I-T-E
CIRCUIT BREAKER COMPANY
Switchgear Division

DIAGRAM OF THE NUCLEAR POWER PLANT

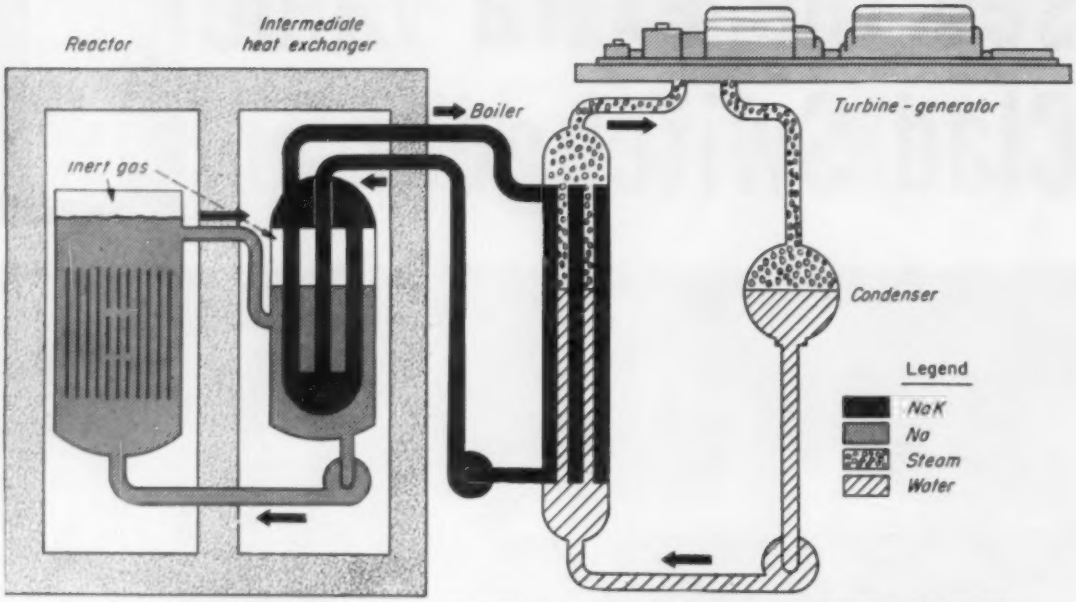


FIG 3—PLANT ARRANGEMENT PROVIDES INTERMEDIATE HEAT EXCHANGER BETWEEN REACTOR AND BOILER

APDA Reactor

(*Continued from page 27*)

and axial blanket elements. Surrounding the core in a radial direction are subassemblies that contain blanket material and are the same size as the core subassemblies. They contain cylindrical rods of depleted uranium.

Both the core and the blanket are cooled by sodium that is pumped into the bottom of the reactor vessel and flows upward through these sections and flows out near the top of the reactor vessel. By using upflow through the core and blanket, decay heat can be removed by natural circulation should this be required as a result of pump failure.

Control . . . Shim control is provided by a boron control rod located at the center of the reactor. Very little reactivity must be accommodated by this control rod so the loss in neutrons is very small. The decision to move poison instead of fuel was made because the heat dissipation requirements are much less and because much more reactivity can be controlled per unit of volume. The control rod with this arrangement is therefore lighter, permitting use of a relatively inexpensive drive.

Safety or shut-down rods are also made of boron. Although these rods contain some 6% delta k, they do not absorb neutrons in normal operation because, under operating conditions, they are located out of the core at the upper edge of the top blanket. They are scrammed by gravity with an initial spring assist.

Mechanical Handling . . . Unloading the core and blanket is accomplished by an element handling mechanism, Fig 1. It consists of a rotating shield plug and an offset handling crane mounted in the plug. A hold-down plate, suspended below the plug, maintains radial alignment of the core subassemblies and holds them down against the pressure drop forces caused by flow through the elements. This plate also acts as a guide for the control element drives.

The sodium level is maintained approximately 11 ft above the core. This is done to:

1. Dissipate decay heat by keeping the fuel subassemblies under sodium during unloading.

2. Provide natural circulation cooling of the core during unloading or on pump failure.

Heat Removal and Use . . . Heat is removed from the reactor core and blanket by circulating sodium. The heat is transferred to an intermediate sodium potassium alloy system and is then transferred to water and steam in a once-through-type steam generator. Fig 3.

Steam is used in a conventional steam turbine that is directly connected to an electric generator. The intermediate circuit is used to prevent a NaK-water accident from releasing radioactivity. An elevation of the plant is shown in Fig 4.

The only items of equipment in the primary system which may require removal for inspection and repair are the pumps and the tube bundles of the heat exchangers. These are made as sump type units with a free surface above the active portions and can be lifted out without cutting the piping and without draining the system.

No isolating valves are used in the primary or secondary systems since they are considered more vulnerable than the piping, heat exchanger housing, and pump housing which they would be called on to isolate. The valves would also unnecessarily increase pressure drop, and it is desirable to keep this to a minimum since the coolant flows by gravity from the reactor tank to the heat exchanger and pump.

A syphon break is provided on the piping at the reactor so that a rupture

in the piping will not drain the reactor tank.

Surrounding the reactor vessel is a so-called primary shield tank which provides containment for sodium in the event of a reactor vessel leak.

The large sodium pool above the reactor contains 15,000 gallons of sodium and contributes the largest part of the 67-sec cycle time for the sodium flow through the primary system. The pool minimizes thermal shocks to the piping system which tend to accrue during reactor scram.

Thermal shock to system parts has also been minimized by:

1. Providing inlet cooling to the high pressure (100 psi) parts of the reactor vessel.

2. Limiting the rise through the reactor to 250F.

3. Designing the top pool and piping with thin walls. Piping is ⅜-in. thick and the pool tank is ½-in. thick.

4. Practically eliminating need, and hence call for scram.

Shielding . . . The thermal shield composed of metal sheets is positioned against the inner wall of the reactor vessel, Fig 4. Its purpose is to reduce the fast neutron flux reaching the reactor vessel to minimize damage from neutron embrittlement and neutron-induced thermal stress.

Compartment shielding is used to provide flexibility in the design and location of the system components. Radial shielding close to the reactor is primarily neutron shielding to reduce induced activation of the secondary coolant system. It consists of two parts, primary neutron shielding of borated graphite and secondary neutron shielding made of Borax, a trade name for $Na_2B407\text{-}10\ H_2O$.

Primary neutron shielding is located in the primary neutron shield tank so that it can be confined and cooled by forced gas circulation. The secondary neutron shielding does not require cooling. Borax can be used as this secondary shielding because it is not exposed to high neutron flux, high temperature, or sodium.

The heat exchanger and pump machinery compartment is located between the Borax shield and the building. The purpose of the personnel shielding around this compartment is to attenuate primary gammas and the secondary gammas which are produced in the sodium. There is about 0.3 curie of radioactivity per cc in the sodium, and it is mainly generated in the sodium pool above the core. Much of the shielding is located outside the building where it acts as structural support and is cheaper to construct than if it were located inside the building.

Reactor Safety . . . Emphasis has been placed on reactor safety. There appears to be no positive temperature coefficient of reactivity. Uranium expansion alone seems to be fast enough to handle any conceivable fast reactivity transient. The operating temperature has been chosen low enough so that, even if all of the control rods are removed, the reactor would shut off short of melting. A serious cold sodium slug accident is avoided by the low operating temperature and by the fact that the system cannot be isolated.

The reactor is unloaded at temperature so that little reactivity is required in the shim control. The number of fuel elements has been chosen so that the maximum reactivity of one element is less than that equal to the delayed neutron fraction. Therefore, if a fuel subassembly were accidently dropped into the core when the reactor is critical, it would not get into a prompt period.

Maximum speed of the control rods

CROSS SECTION OF PLANT

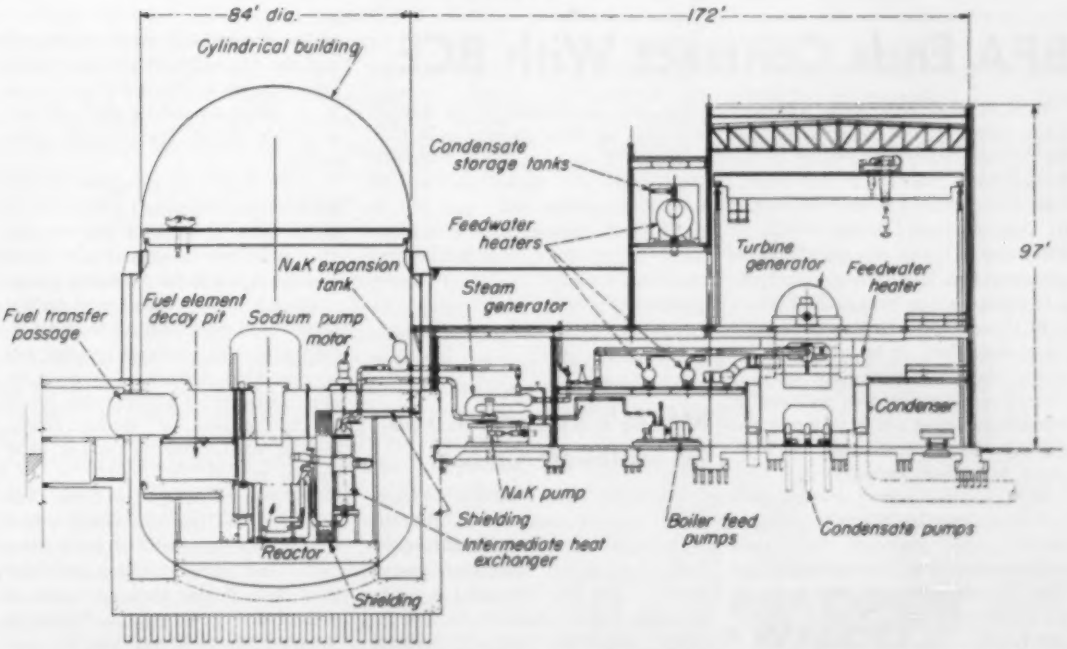


FIG 4—HEAT GENERATED IN REACTOR WILL BE PICKED UP BY SODIUM-POTASSIUM ALLOY AND TRANSFERRED TO WATER

is 0.007% delta k per second so that during the start-up it cannot get into a prompt period. The fuel subassemblies are also inserted at this rate so that even if the core were accidently critical during loading, the prompt period accident would be avoided.

Containment . . . An airtight steel cylindrical reactor building (at left in Fig 4) encloses the reactor; the fuel handling mechanisms; the intermediate heat exchangers; and the sodium pumps, piping, and storage tanks. It is approximately 84 ft in diameter and has a wall thickness of about 1½ in.

Purpose of this building is to contain the products of any possible reactor accident resulting in a release of fission products and radioactive sodium. All air is de-humidified and enriched in nitrogen to minimize the likelihood of a sodium-oxygen reaction should a leak occur in the liquid metal system.

May Boost Output . . . Flexibility has been designed into the system. All mechanisms are removable. The rotating plug is removable in layers. The control drive, rods, and thimbles are removable. The fuel subassembly support plates can be removed. The fuel and blanket subassemblies are made the same size so that they are interchangeable. Therefore, the core size can be adjusted during initial start-up to achieve criticality. Furthermore, after a number of years of successful operation at design power, the core size can be increased to increase the power output.

Design of the reactor has been established and a full-scale mechanical test facility of the reactor and one primary loop is being constructed. This facility will not contain fissionable material. It is designed to prove the mechanical and hydraulic operation of the reactor. This facility will be completed by early 1956. The reactor plant is expected to go into operation late in 1959.

There are many design features of the reactor which remain to be demonstrated, but there appear to be no problems for which a solution is not foreseeable.

Economics . . . Detailed estimates of the reactor cost, based on informal price quotations from equipment manufacturers, indicate that close to $30 million will be required for designing the reactor, procuring and erecting the structure and equipment. This does not include a large amount of research and development work, administrative and other costs.

Because of the developmental nature of the present reactor, the conservatism in design, and the large allowances provided in estimates for capital costs, it is not anticipated that this reactor plant will be competitive with modern thermal plants. The project, however, will furnish the experience and know how needed to permit the achievement of high standards.

Future Possibilities . . . The future potential for the fast reactor is great. It appears possible to use a liquid fuel for the blanket, and eventually for the core. Use of a liquid fuel will tend to simplify processing problems and will enable continuous operation of the reactor without need for shutdowns for refueling. Research and development work is under way to achieve these goals, which are not being designed into this reactor plant.

It is believed that with the higher performance which will be obtained with the second and subsequent plants, coupled with lower capital costs, as a result of experience gained with this first plant, power costs competitive with present modern thermal power plants will be achieved.

BPA Ends Contract With BCE

Because Columbia River developments have, at least temporarily, met the growing electrical demand in the United States Northwest, the Bonneville Power Authority has terminated its contract with British Columbia Electric Co. Under this the Canadian company had funnelled electricity to a four-state power pool since 1948.

BCE spokesmen in Vancouver said the contract has, up to now, been renewed every two years, but when it expired recently the pool indicated it was not necessary for it to renew the contract which has brought the BCE about $1 million annually.

BCE said the export of electricity had been about 200,000,000 kwhr annually, about one-tenth the power consumption of the Lower Mainland of B. C., and had gone into the pool for use in Washington, Oregon, Idaho, and Utah.

The power came from BCE's reserve, and cancellation of the contract will have no effect on rates in B. C.

But BCE said the power lines running across the border are "an extremely important link" and will be maintained. Consequently, if an emergency arose, the Canadian company could still easily export or import power.

McKay's Removal Asked by Southwest Co-ops

Southwest rural electrical cooperatives, meeting recently at Phoenix, Ariz., went on record demanding removal of Interior Secretary Douglas McKay and two of his top aides, Clarence Davis, undersecretary of Interior, and Fred Aandahl, assistant secretary.

The demand was made on grounds that the trio withheld sale of 130,000 kw of power to Southwestern co-ops in an effort to induce them to buy substitute power from private companies.

More than 400 delegates of 107 REA co-ops conducted a two-day regional meet at Arizona and adopted 16 resolutions—strongest of which was the demand for McKay's ouster.

Tibor F. Nagey, director of nuclear research of the Glenn L. Martin Co., Baltimore, was principal speaker and warned REA delegates European nations threaten to outstrip the U. S. in development of atomic power. Britain, particularly, is making great strides, he said.

The group of co-ops also urged Congress to pass the Lehman-Davidson bill for development of Niagara River power and demanded that the New York State Power Authority draft an over-all marketing plan to "fulfill its obligation to rural and domestic customers on an area-wide basis."

Re:

METALS

HOW STRONG MUST METALS BE?

Obviously, if the science of steam generation is to continue to advance—as it must—the development of alloys is of fundamental importance. Before higher pressures and temperatures can be utilized, alloys must be found to withstand them and also offer greater resistance to corrosion and oxidation —all this within feasible economic limits. Somewhere between the costly "exotic" metals and plain carbon steel lie answers that will help pace the future progress of steam generation.

For example, at B&W's Research Center, development of greater strength in metals to withstand higher *pressures* and *temperatures* begins with the melt operation to protect essential high purity, and continues through batteries of exhaustive testing procedures. To better withstand *corrosion,* new alloys are being developed and tested for use in structural members such as superheater supports in oil-fired furnaces. In the particularly troublesome area of *welding dissimilar metals* (ferritic to austenitic) a newly developed alloy, still in the testing stage, is showing considerable promise. And work in welding techniques has recently helped develop a welding method that materially increases the rate of weld metal deposition with the submerged arc welding process.

Here, the work of research, development and testing never ends, for as progress is made new problems arise. How can costs be reduced further while achieving operating temperatures of 1200 F and higher? How soon will a satisfactory material be developed to withstand the corrosion common to oil-fired units? Can better alloys be developed to overcome the problem of radiation in nuclear power reactors?

Specialists at B&W's Research Center continue to examine every facet of metallurgy affecting steam technology, governed always by the realities of steam generation economics. The intensity and continuity of these highly skilled efforts—concerned also with fuels, combustion, furnace design, heat transfer, fluid flow, water and steam purity, and nuclear energy—have already been responsible for acknowledged major advances. And as long as progress remains to be made, B&W will be dedicated to making it.

6 PM
4 PM
3 PM
WESTINGHOUSE ELECTRIC CORP. MADE IN U.S.A. TYPE 44 INSTRUMENT CHART
Style No. 172657
Lot D&E K-1

Helping the industry meet its growing loads

Designing instruments to help management make sound decisions

Electric utility managements continually face the urgent question, "How do we improve present system efficiencies and intelligently plan for future capacities?"

To be of true value, their answer to that question must be founded upon accurate, up-to-date information about their own particular operations.

Westinghouse has long anticipated that today's swiftly paced expansion in power systems would accentuate the need for accurate recorded information, a basic foundation in making sound management decisions. Needs of the industry were surveyed, and one timely answer to the kind of instruments desired now appears in the new Westinghouse line of strip chart recorders—the Type 44.

Operational efficiencies and economies are studied by means of the recording voltmeters. Recording varmeters show where the power is being wasted and corrective measures are needed. Recording wattmeters and ammeters give you the information necessary to plan for load growth, proper distribution, and the addition of generating equipment and distribution facilities.

All of these new recording instruments can help you cut costs, develop more reliable operation, make better planning decisions for the future. Indirectly, they will also help you maintain stability and continuity of service, thereby protecting customer good will.

The Type 44 recorder is another example of Westinghouse contributions to electric equipment pioneering. Westinghouse makes a full line of electric measuring instruments for every electric utility requirement—will gladly help you apply them to your instrumentation systems. J-97191

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Greater Accuracy

New, iron-core measuring mechanisms develop twice the torque of previous designs . . . provide faster response, accuracy within 1% under all operating and load conditions.

Ease of Use and Service

All parts are fully accessible from front of recorder, a particular advantage in flush switchboard mounting.

Versatility

Used to make operation and load studies in electric power generating stations, substations, field surveys, and in field service. Also used in industrial applications to check machine performance and factory distribution systems.

Less Mounting Space

Recorder has highest ratio of scale width to panel area, is attractive in appearance and easy to read.

Economy

Less maintenance, long charts last 70 days . . . large ink capacity permits operation for greater unattended periods.

Dependability

Extremely high overload capacity reduces possibility of burnouts. All mechanisms self-shielded against stray magnetic fields.

For more information on Type 44 recorders, call your Westinghouse representative or write direct to Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Smith Heads Gulf Power

Lansing T. Smith, Jr, has been advanced from vice president and general manager of Gulf Power Co to president and general manager. He succeeds James F. Crist, president since 1948, who will continue as a director and vice president.

Smith joined the power company in 1926 as executive assistant, and was appointed new business manager in 1933. After serving as sales promotion manager for seven years, he was promoted to assistant to the general manager in 1949, a position he held until his 1951 appointment as vice president. He was named vice president and general manager in 1953.

Prior to joining Gulf Power, Smith served as superintendent for the Northern Division of Alabama Power Co. An electrical engineering graduate of Alabama Polytechnic Institute, he is a director of Southeastern Electric Exchange and of Southern Services, Inc.

L. T. SMITH, JR

H. RESTOFSKI

R. G. MACDONALD

J. F. MCQUILLIN

J. E. MUELLER

West Penn Promotes Officials, Forms Planning Department

West Penn Power Co has announced the creation of a business planning department headed by Vice President Harry Restofski and the appointment of Robert G. MacDonald as vice president. Also promoted were J. F. McQuillin, John E. Mueller, and Earl J. DeChambeau.

Organized to set up and develop long-range objectives, plans, and policies, the new executive staff department will make forecasts, economic studies, and projections of organization and manpower needs. It will also include rate research development and administration, formerly a marketing department function.

Restofski, marketing vice president since 1951, has served in every major department during his 41 years with the utility. His previous posts include assistant to the vice president in charge of the power department, general safety director, assistant to the president, assistant general manager of West Penn Appliance Co, sales promotion manager, and general sales manager.

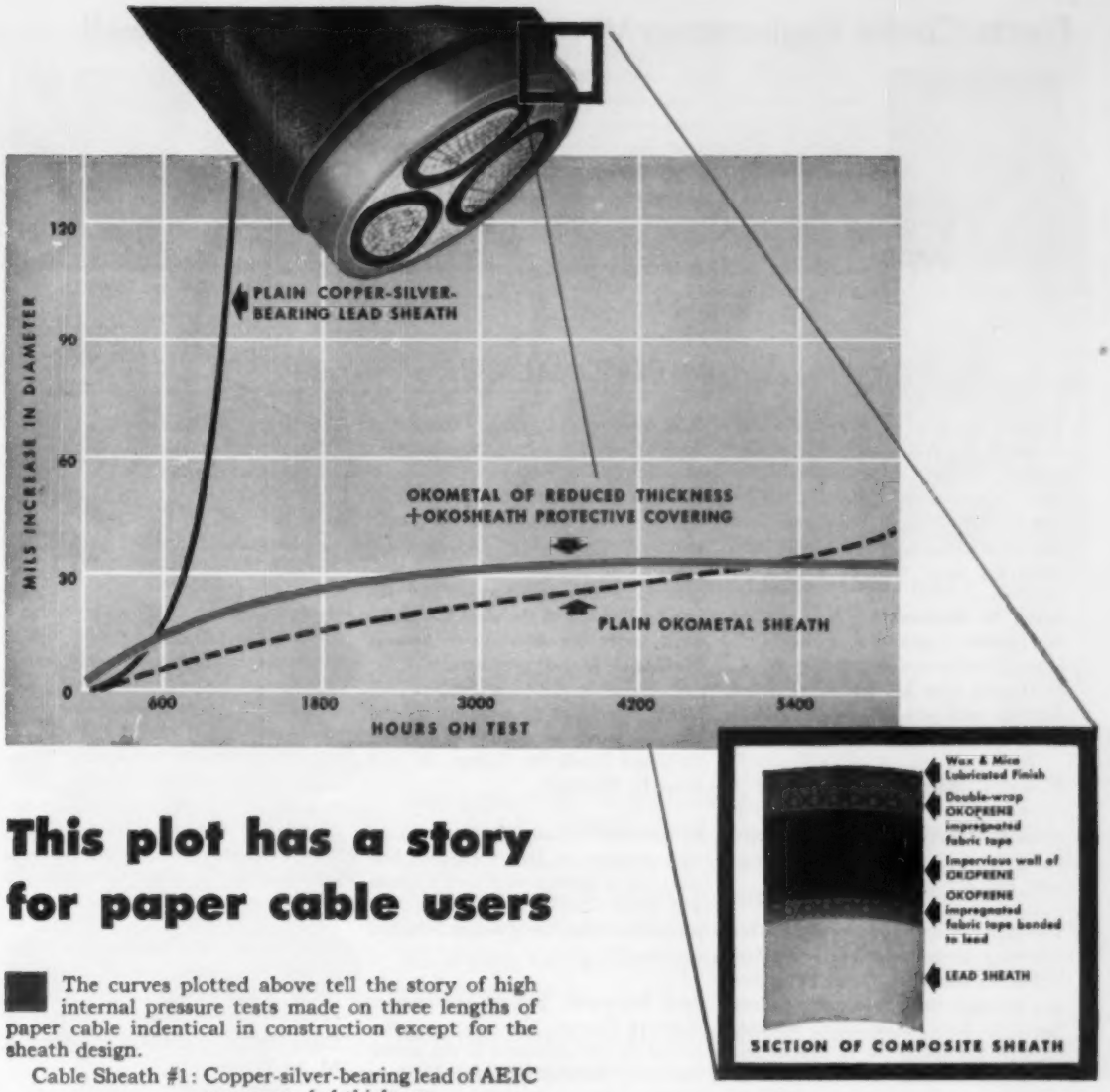
Mueller, executive assistant to the president, has been named manager of planning for the new department. During his 28 years with the utility, he has also been residential and commercial sales manager, and manager of policy adminstration.

MacDonald, who will head the marketing group, has been manager of general services since last year. Since joining West Penn in 1931 he has served as Keystone Division manager, and assistant to the operating vice president. He was made assistant vice president in 1953.

E. J. DECHAMBEAU

McQuillin, who succeeds MacDonald, is former manager of methods engineering. He has also served as power department staff engineer and as chief mechanical engineer.

Advanced from senior methods engineer to replace McQuillin is Earl J. DeChambeau, who joined the methods engineering department upon its organization in 1953. Prior to that he served as operating department's training supervisor.



This plot has a story for paper cable users

The curves plotted above tell the story of high internal pressure tests made on three lengths of paper cable indentical in construction except for the sheath design.

Cable Sheath #1: Copper-silver-bearing lead of AEIC recommended thickness

Cable Sheath #2: Okometal alloy of AEIC recommended thickness

Cable Sheath #3: Composite design with Okometal alloy of two-thirds AEIC thickness plus Okosheath Protective Covering

Sheath #1, having the least resistance to internal pressure, started to "neck down" or thin-out at one spot, which led to a rapidly increasing expansion and failure after only 1152 hours on test. Sheath #2, made with unprotected Okometal of full AEIC thickness, was still on test after 6000 hours, indicating its superiority over a conventional lead sheath. Composite sheath #3, made with Okometal of reduced thickness but having an Okosheath Protective Covering, was not only still on test after 6000 hours, but also showed a flat curve that indicated the highest degree of stability with no tendency to "neck down."

Along with the advantages disclosed above, the composite sheath construction of Okometal plus Okosheath Protective Covering possesses superior resistance to scoring during installation and eliminates both chemical and electrolytic corrosion. These features are fully discussed in Bulletin **EW-1047**, available upon request from The Okonite Company, Passaic, New Jersey.

Available with either copper or aluminum conductors

OKONITE *insulated cables*

Elects Clarke Engineering VP

A. H. CLARKE

Albert H. Clarke, commercial vice president of Crouse-Hinds Co since 1952, has been named vice president in charge of engineering. Clarke, a Syracuse University graduate, joined the company in 1925 and has also served as illumination manager. He succeeds Carl H. Bissell, retiring after 53 years with the company.

General Cable Ups Powell

General Cable Corp has announced the appointment of William M. Powell as general sales manager for the corporation.

Powell started in the sales organization of General Cable in 1929 and in 1954 was promoted to branch manager of the eastern district with headquarters in New York.

W. M. POWELL

PERSONAL BRIEFS

Virginia Electric & Power Co has elected **E. H. Will,** vice president and general manager since 1954, to the board of directors. He succeeds **William E. Wood,** retired Vepco executive vice president who has recently tendered his resignation as a director.

Frank W. Michaux has been elected to Houston Lighting & Power Co's board of directors, succeeding **W. A. McDonald** who has retired as board member and general superintendent of the power department.

Walter J. Barrett, treasurer and a director of the American Institute of Electrical Engineers, has been elected president of United Engineering Trustees, Inc, for the ensuing year.

Montana Power Co has announced the following appointments, effective Jan. 1: **Dix C. Shevalier,** Great Falls division manager since 1953, will be transferred to Butte as executive assistant to Vice Presidents **T. L. Doran** and **C. J. Burns** under the utility's management training program; **M. R. Byers,** manager for the Lewistown Division, succeeds Shevalier; and **W. W. Talbott,** Missoula Division assistant manager and customer service manager, has been promoted to Lewistown Division manager.

Delaware Power & Light Co's **Robert D. Weimer** has been named plant superintendent of its Delaware City Power Station under construction adjacent to the new Tide Water Associated Oil Co refinery.

H. H. Watson, vice president and assistant to the president of Northern States Power Co, has retired after 44 years with NSP and affiliated companies.

B. J. Yeager, who recently completed 25 years service with Cincinnati Gas & Electric Co has been appointed manager of electric production. In an organizational change following the retirement of **Darwin S. Brown,** vice president in charge of electrical production, electric production has become a division of the electric department under the direction of **Samuel M. Hamill, Jr,** vice president.

Newly appointed as assistant general counsels for Westinghouse Electric Corp are **Frank W. Gaines, Jr,** and **John L. Howland.**

Dr Lauchlin M. Currie has been named vice president of Union Carbide Nuclear Co, a division of Union Carbide & Carbon Corp. He is former vice president of another division, National Carbon Co.

Jack Whiteside, general manager of Simpson Electric Co, has been promoted to vice president of the parent company, American Gage & Machine Co, in charge of Simpson Electric Division.

Kaiser Aluminum & Chemical Corp has appointed **Joseph W. St. Andre** as chief electrical engineer at the company's Newark, Ohio, rod, bar, wire, and electrical conductor mill. Formerly employed by Continental Electrical Equipment Co, he has also served as electrical editor of Factory magazine, a McGraw-Hill publication.

Daniel M. Fuge, assistant general sales manager, has been appointed general merchandise manager of General Cable Corp. Also promoted were **Charles M. Sherwood** as assistant general sales manager and **Charles L. Wiley** as advertising and sales promotion manager. Sherwood is former New York branch manager, and Wiley served as product sales manager.

West Penn Power Co's new manager of personnel services is **Rodger W. Murtagh,** former welfare manager.

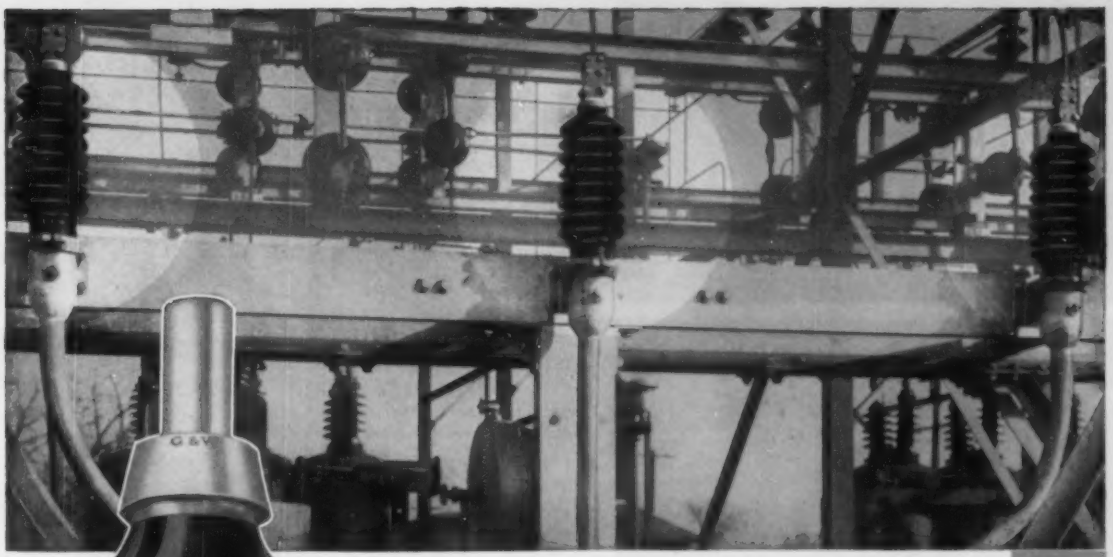
Hotpoint Co, in a recent realignment of its organization into product departments, has appointed the following officials to head the new departments: **John F. McDaniel,** range and component parts; **Orrin E. Wolf,** refrigeration; **Ralph M. Spang,** home laundry; **Edward M. Haines,** dishwasher, water heater, and custom appliances; **William C. Ayres,** commercial equipment; **William A. Kissock,** relations and utilities; and **Irvin L. Stephenson,** legal.

After 44 years with Electric Controller & Manufacturing Co, **A. A. Piper** has resigned as Chicago district manager to become a company consultant in the Chicago area. His successor is **M. E. Young.**

Westinghouse Electronic Tube Division has appointed **Harvey T. Harrod** manager of its government contract administration. He was former assistant sales manager for defense products at the company's Pittsburgh office.

OBITUARY

Frank W. Wentworth, 75, retired president of East Bay Municipal Utility District, Oakland, Calif., died at his Berkeley home. He was elected a director of East Bay MUD in 1933 and became vice president in 1941. He served as president from 1943 until his retirement three years later.



Assure . . . permanent protection for cable ends

Soldered Porcelain
TYPE "ST" POTHEADS

These potheads are factory assembled, with metal-to-porcelain soldered joints. This method completely eliminates the possibility of future trouble due to loosely gasketed joints. When these potheads are used, the responsibility for properly sealed joints rests entirely with our factory. Troubles due to aging, cold flow and permanent set of gasket materials are eliminated.

Since their introduction in 1940, type "ST" Soldertite potheads have achieved an excellent service record on gas filled as well as standard cables. Many electric utilities companies have standardized the use of them.

Send for Bulletin AA50 (listing "ST" potheads) and for Bulletin A52 (data on makeup of stress relief cones.)

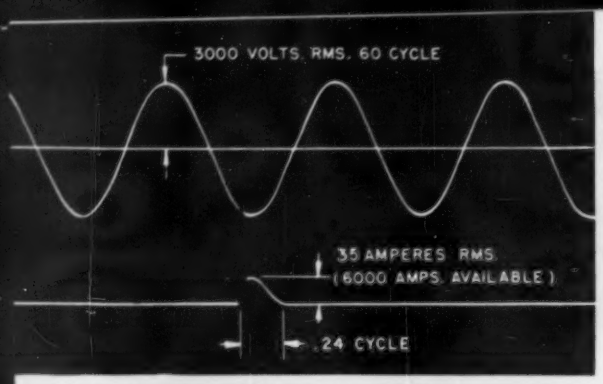
G & W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois, U.S.A.

Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd.,
Toronto, Montreal & Vancouver

1905
50th ANNIVERSARY
1955

G&W

A523A

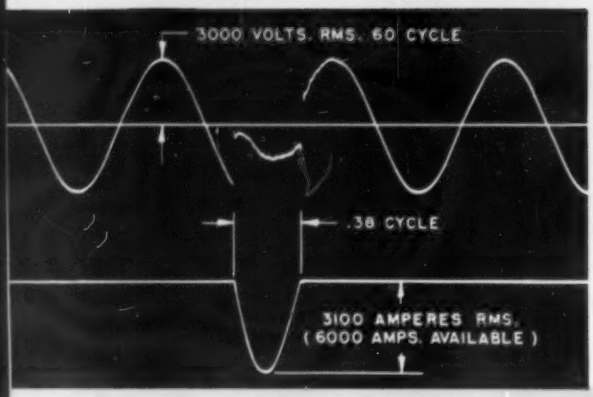


VALVE ARRESTERS HANDLE

HIGH

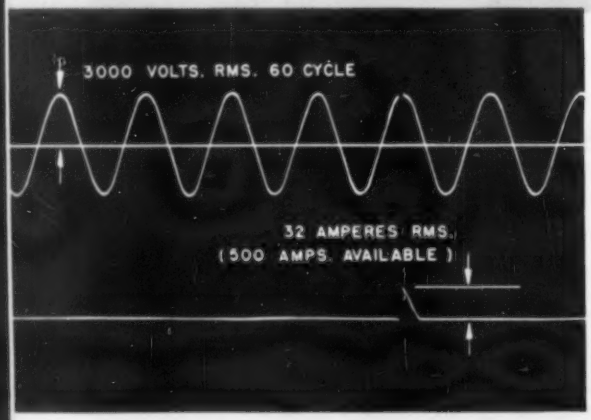
FAULT CURRENTS BETTER

VALVE Type Arrester, on a 3000 volt, 60-cycle system, with 6000 amperes available, draws 60-cycle power follow current of only 35 amperes RMS.



EXPULSION Arrester, on the same system, draws 3100 amperes follow current—over one-half the available short-circuit current.

Valve Arresters Are Not

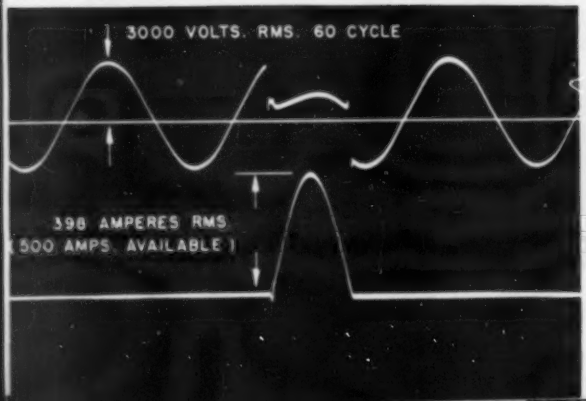


VALVE ARRESTERS HANDLE

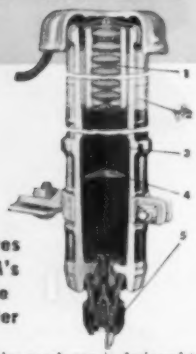
LOW

FAULT CURRENTS BETTER

VALVE Type Arrester, on a 3000 volt, 60-cycle system with 500 amperes available, draws only 32 amperes, as shown in this oscillogram. And it interrupts the follow current in a half-cycle, or less.



EXPULSION Arrester, on the same system, draws 398 amperes. An eroded expulsion arrester may not develop enough pressure to clear the arc—and a sectionalizing device would operate unnecessarily.



Features of L-M's Valve Arrester

1. The ladder spark gap is designed to provide an optimum balance between 60-cycle sparkover and impulse sparkover.

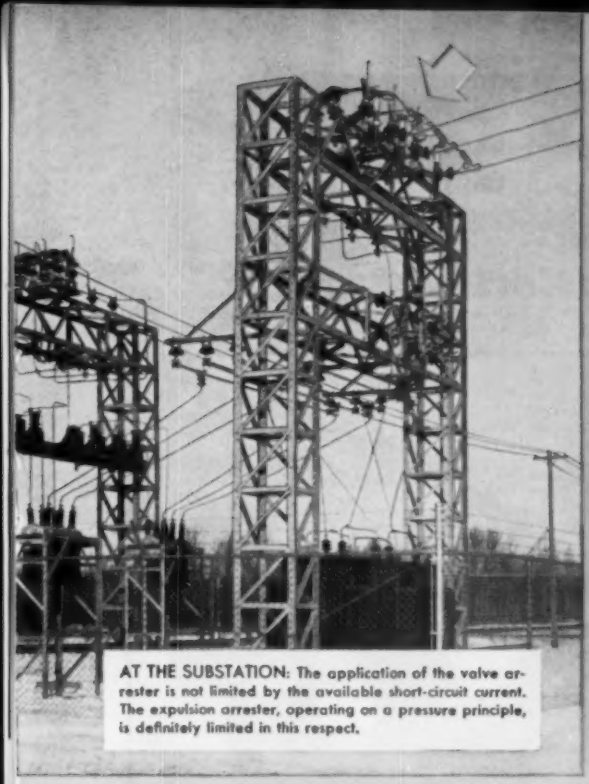
2. The Pyrex glass housing permits visual inspection to detect mechanical or electrical damage.

3. "Granulon," the valve material, is able to withstand severe heating which accompanies heavy strokes of lightning.

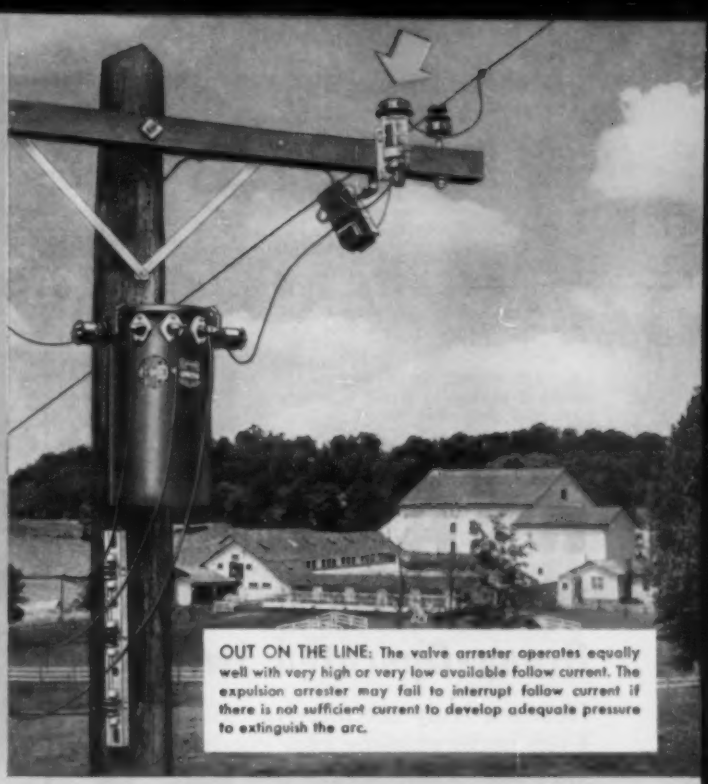
4. Lens-shaped electrodes in the element compensate for "skin effect," assuring uniform distribution of surge current throughout the valve element.

5. L-M's exclusive "Isolator" gives positive assurance against grounding feeders by instantly disconnecting the ground lead from the arrester if the arrester should ever become damaged.

LM® **LINE**



AT THE SUBSTATION: The application of the valve arrester is not limited by the available short-circuit current. The expulsion arrester, operating on a pressure principle, is definitely limited in this respect.



OUT ON THE LINE: The valve arrester operates equally well with very high or very low available follow current. The expulsion arrester may fail to interrupt follow current if there is not sufficient current to develop adequate pressure to extinguish the arc.

Affected By System Capacity

...Another Reason Why Valve Types Are Better Than Expulsion Arresters

by **RALPH H. EARLE**
Chief Engineer
General Products
Line Material Company

L-M engineers have made thousands of tests and observations of the performance of both valve and expulsion type arresters. They have worked closely with operating companies on comparative tests. The inescapable conclusion is that the valve principle results in superior arrester performance.

One of the major advantages of valve type arresters is that they are no respecters of system capacity. They work equally well at the bus of the largest generator made, or at the most remote point of a rural line.

This is not true of expulsion arresters. They pass far more power follow current, and erosion on the expulsion arrester is rapid, life is comparatively short.

Valve type arresters work equally well on small surges, and on systems with very low fault currents. In such situations an expulsion arrester may take several cycles to interrupt follow current. A badly eroded expulsion arrester may not work at all, thus blowing the sectionalizing fuse, or causing unnecessary recloser operation.

When 60-cycle system capacity is considered, valve arresters are preferred because:

- **A** the valve arrester has unlimited 60-cycle capacity. It operates equally well with very high or very low available follow current.
- **B** valve arrester life is completely independent of 60-cycle system capacity.
- **C** the expulsion arrester, which operates on the pressure principle, may explode because of pressures developed if its fault current rating is exceeded.
- **D** the expulsion arrester may fail to interrupt follow current if there is not sufficient current to develop adequate pressure for arc interruption.

Why This Policy

When a manufacturer of two types of arresters adopts a policy of recommending *one* of the two types, there must be a good reason. The facts behind this policy are given in a new bulletin, "Valve Versus Expulsion Type Arresters." Ask your L-M Field Engineer for a copy, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Co. Div.).

FOUR PRINCIPAL REASONS
For Recommending Valve Over Expulsion Arresters

1. Better Protective Characteristics—The valve arrester sparks over more quickly and at lower voltages on lightning surges.

2. Unlimited 60-Cycle Capacity—The application of the valve arrester is not limited by the available short-circuit current.

3. No Fuse Coordination Problems—The valve arrester will pass relatively small values of 60-cycle follow current, regardless of system capacity.

4. Longer Life—The valve arrester is electrically and mechanically unaffected in handling lightning discharges usually encountered in service. Its life is relatively unlimited.

MATERIAL Lightning Arresters

DEPENDABLE...

despite weather or structural warpage!

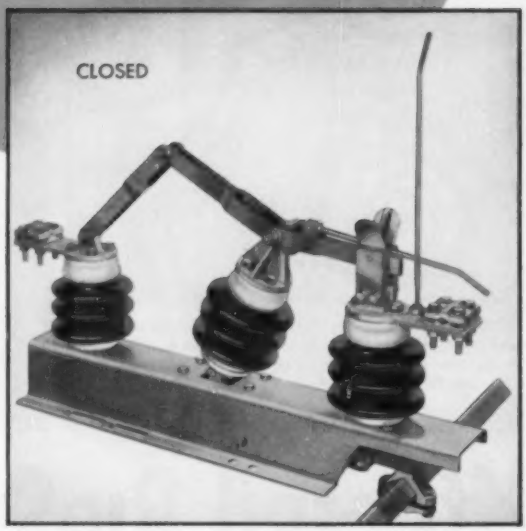
KEARNEY

Tilting Insulator Group-Operated Switches

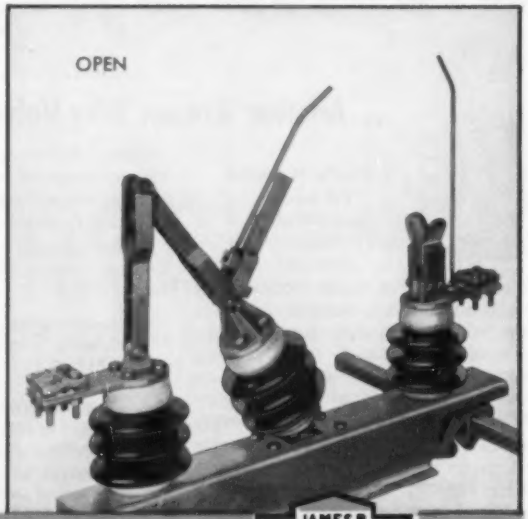
Here's a truly trouble-free disconnect! Even under extreme icing conditions, the "pry-out" blade breaks free easily. The high leverage of the Kearney "toggle" linkage lifts it from the jaws smoothly and easily . . . closes it without slam or damage to the insulators.

And it will work perfectly even if the switch poles are out of alignment. The interphase shaft clamp is designed to compensate for structural warpage. For easy installation, the interphase shaft can be lifted into the clamps after the switch is in position.

- *Oilite bearings support the tilting insulator*
- *Extra long jaws . . . blade travel adjustment need not be critical*
- *Silver-plated blade-to-jaw contacts*
- *Sturdy, deep-drawn base with wide bearing flange to prevent cutting into crossarms*



TYPE KT-3 Ratings 400 - 600 AMP. 7.5 to 34.5 KV.



275

For Better Construction . . . Safer Maintenance

Specify **KEARNEY** *The Mark of Quality* **PRODUCTS**

JAMES R. KEARNEY CORPORATION • 4224-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO

MEETINGS CALENDAR

An extended list of coming meetings appears in the last issue of each month

NOVEMBER

ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM—East North Central Region, Detroit, Nov. 21-22.

INTER-INDUSTRY FARM ELECTRIC UTILIZATION COUNCIL—2nd Annual National Power Use Workshop, Chase & Park Plaza Hotels, St. Louis, Mo., Nov. 28-30.

AIR CONDITIONING & REFRIGERATION INSTITUTE—9th Air Conditioning & Refrigeration Exposition, The Auditorium, Atlantic City, N. J., Nov. 28-Dec. 1.

EDISON ELECTRIC INSTITUTE—Adequate Wiring Promotion, EEI Headquarters, N. Y., Nov. 30-Dec. 1.

* **WESTINGHOUSE ELECTRIC CORPORATION**—5th Annual Power Supplier Conference, Conrad Hilton Hotel, Chicago, Nov. 30.

DECEMBER

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS—51st Annual Meeting, Hotel Traymore, Atlantic City, Dec. 1-3.

* **EDISON ELECTRIC INSTITUTE**—Commercial Division of Executive Committee, EEI Headquarters, N. Y., Dec. 2; Commercial Sales Group Electric Space & Air Conditioning Committee, Terrace Plaza Hotel, Cincinnati, Dec. 5-6; Commercial Sales Group Street Lighting Committee, Indianapolis, Dec. 6-7; Commercial Sales Group Cooking & Water Heating Committee, Hotel Statler, Boston, Dec. 7-9; Customer Accounting Committee, sponsored jointly with American Gas Association, Henry Grady Hotel, Atlanta, Ga., Dec. 8-9; Industrial Relations Committee, EEI Headquarters, New York, Dec. 15.

NATIONAL ASSOCIATION OF COST ACCOUNTANTS—Fairmount Hotel, San Francisco, Dec. 2-3.

AMERICAN WATERSHED COUNCIL, INC—Second National Watershed Congress, Statler Hotel, Washington, D. C., Dec. 5-6.

INTERNATIONAL EXPOSITION—25th Exposition of Chemical Industries, Convention Hall, Philadelphia, Pa., Dec. 5-9.

ELECTRIC COMPANIES ADVERTISING PROGRAM—Copy Group Meeting, Drake Hotel, Chicago, Ill., Dec. 7.

NATIONAL ASSOCIATION OF MANUFACTURERS—60th Congress of American Industry, Waldorf-Astoria, New York City, Dec. 7-9.

ENGINEERS JOINT COUNCIL—Nuclear Engineering & Science Congress, Public Auditorium, Cleveland, Dec. 12-16.

* **ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM**—Steering Committee, Biltmore Hotel, New York, Dec. 13.

JANUARY 1956

WEED SOCIETY OF AMERICA—Charter Meeting, Hotel New Yorker, New York City, Jan. 4-5; Northeastern Weed Control Conference, Annual Meeting, Hotel New Yorker, N. Y., Jan. 6.

EDISON ELECTRIC INSTITUTE—Financing & Investor Relations Committee, Hotel Biltmore, New York, Jan. 19; Industrial Relations Committee, EEI Headquarters, New York, Jan. 19; Prime Movers Committee, Warwick Hotel, Philadelphia, Jan. 30-Feb. 1.

* **OKLAHOMA UTILITIES ASSOCIATION**—Accounting Section, Alvin Hotel, Tulsa, Okla., Jan. 20.

* **AMERICAN SOCIETY HEATING & AIR CONDITIONING ENGINEERS**—Annual Meeting, Cincinnati, Jan. 23-25.

NATIONAL RURAL ELECTRIC COOPERATIVE—14th Annual Meeting, St. Louis, Jan. 23-26.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Fairmount Hotel, San Francisco, Jan. 24-27.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter General Meeting, Hotel Statler, New York, Jan. 30-Feb. 3.

FEBRUARY

* **MISSOURI VALLEY ELECTRIC ASSOCIATION**—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 2-3.

INDUSTRIAL ELECTRIFICATION COUNCIL—National Industrial Electric Heating Conference, Netherland Plaza Hotel, Cincinnati, Feb. 6-10.

* **EDISON ELECTRIC INSTITUTE**—Transmission & Distribution Committee, Warwick Hotel, Philadelphia, Feb. 7-8; Electrical Equipment Committee, Homestead, Hot Springs, Va., Feb. 13-14; Commercial Lighting Committee, Hotel Shoreham, Washington, D. C., Feb. 15-16; Meter & Service Committee, Hotel Cleveland, Cleveland, Feb. 20-22.

* **PENNSYLVANIA ELECTRIC ASSOCIATION**—Relay Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 9-10; Electrical Engineering Committee, Penn Harris Hotel, Harrisburg, Pa., Feb. 9-10.

SOUTHEASTERN ELECTRIC EXCHANGE—Personnel Administration Section, Buena Vista Hotel, Biloxi, Miss., Feb. 9-10.

ROCHESTER ELECTRICAL EXPOSITION—War Memorial Building, Rochester, N. Y., Feb. 18-25.

NATIONAL ADEQUATE WIRING BUREAU—12th Annual Conference, LaSalle Hotel, Chicago, Feb. 23-24.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, Feb. 27-March 2.

MARCH

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton Hotel, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York City, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, March 12-16.

ILLINOIS INSTITUTE OF TECHNOLOGY—18th Annual American Power Conference, Hotel Sherman, Chicago, March 21-23.

APRIL

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Conference on Recording & Controlling Instruments, Bradford Hotel, Boston, April 26-27.

* Additions this week.

POWER BRIEFS

• Federal Power Commission has granted a 50-year license to the city of Eugene, Ore, for construction of its $8.5-million, 30,000-kw Beaver Marsh hydroelectric project on the McKenzie River, in Lane and Linn Counties.

• The lure of uranium and a major industrial power customer has led Arizona Public Service Co to open construction on an 85-mile long, 69-kv power line from Flagstaff to Tuba City. The new line will serve a $2.5-million ore-crushing mill to be built by Rare Metals Corp at Tuba City.

• Construction is underway at Anchorage, Alaska, on a $2-million program to increase the steam generating capacity of the Chugach Electric Association's Knik Arm power plant from 9,500 to 14,500 kw. Completion of construction and the beginning of operations of the new 5,000-kw steam generator is scheduled for the fall of 1956.

• Northern California is planning construction of ten hydroelectric power plants on the Eel River as part of a statewide California Water Plan to be completed in 1957. Although objective is to supply water to six North Bay counties, the system would also generate 2,600,000,000 kwhr of electrical energy per year. The plan, which includes three dams and reservoirs and two pumping plants on the Eel River, will not conflict with the Feather River or Trinity River projects.

What Price Federal Power?

by ADMIRAL BEN MOREELL
Chairman, Hoover Commission Task Force on Water Resources & Power

"It is just as true today as it was a century and one-half ago, that the condition under which God has given liberty to men is eternal vigilance. Whether the demagogues advocating public power are or are not socialists is not important. What is important is that the price we pay for public power must be measured by the advance of socialism in our midst and our concurrent loss of liberty."

(Condensed from speech before Association of Edison Illuminating Companies)

The following excerpt from the Task Force Report is pertinent to our consideration of this subject:

"Since there is no present or prospective necessity for Federal power development to overbalance the social undesirability of continuing such activities, the task force finds that they are not essential Federal activities. This task force believes that the Federal Government does not owe a responsibility to supply any community, section, or region, with its power requirements. Nor does the presence of potential water-power in a Federal water resource development project necessarily constitute a mandate for its development; but when such potential power can be developed in accordance with sound business principles, it should be developed in the national interest by selling the potential or the power at the lowest technological level which will produce fair returns to the Federal Government."

Without doubt, power generation and distribution are the most important of our studies, for two reasons: first, because those who advocate intrusion by the government into the economic affairs of its citizens have found that this issue has a strong popular appeal, which makes it a convenient vehicle on which political demagogues can hitch-hike into public office; and second, because socialization of electric power can easily lead to socialization of all large-scale industry. He who controls power can have a large measure of control over all of industry.

There is no logical reason for the popular appeal of public power. But demagogues have been able to hoodwink the public into believing that it is an important factor in their cost of living. Actually, the cost of power to the average householder is about 1% of his family budget, as against 29% for food, 9% for clothing, and 2% for tobacco and smoking supplies. A reduction of only 3% in his tax bill would pay for all of his power! But the demagogue conveniently forgets about tax reduction. He says that high taxes, the spending of which he controls, are essential to "promote the general welfare."

As for manufacturing, except for the electrochemical and electrometallurgical industries, the cost of power averages little more than ½ of 1% of the product value. For the two industries it averages a little over 10%.

Technically and financially there is no present nor prospective need for Federal public power. Private industry is amply able to finance and install needed generating, transmission, and distribution facilities. Since the end of World War II, investor-owned electric companies have spent approximately $20 billion for such facilities, as against an approximate *total* expenditure by the Federal Government, from the very beginning of its program in 1906 to mid-1953, of only $2.3 billion.

Federal Agencies in the Red

The Task Force concluded that if all Federal power rates had been based on power values computed in accordance with methods prescribed by the Federal Power Commission, the rates would be increased 30 to 50%; and the government would have received $130 million more in power revenue in 1953 alone. If the present Federal rates are continued for the power projects now programmed, this revenue loss, which in its effect is a subsidy, could amount to $400 million a year.

Proponents of the public power program have charged that since public power systems never have been called upon to pay Federal income taxes, they should be exempt from any participation in support of the government. These partisans have taken figures prepared by the Task Force and purport to show that the requirements proposed by the Task Force, excepting all taxes, could have been met and still have left a surplus for the Federal Treasury. Their arithmetic conceals the facts. For the year 1953 the TVA record shows that even on this basis, there would have been a deficiency of approximately $2 million, provided, however, that TVA

would not be reimbursed for the $3.4 million paid by it to state and local governments as compensation for taxable properties removed from their tax rolls.

The Southwest Power Administration and the Southeast Power Administration make no payment in lieu of taxes and the deficiencies of these two systems would have been respectively approximately $2½ million and $4¾ million. The whole Federal power program for that year would have been deficient by about $1¼ million.

The General Accounting Office, in its audit, reported that additional revenue necessary to cover the cost of producing electric energy and to amortize the government's investment in Southwestern Power Administration as based on Corps of Engineers' estimates was deficient in 1952 by $818,000 and in 1953 by $1,230,000. The Task Force figures, of course, show that the deficiencies for these two years were considerably greater. Our studies used an interest rate of 3% and made allowance for Federal, state, and local taxes. **My point is that the revenues do not even meet the costs as computed by the agencies themselves.**

Double Standard Bookkeeping

Those favoring big government, paternalism, government-ownership, socialism—call it what you will—give control of electric energy by government high priority. Such control can be obtained only if the movement has popular support—or lacks popular opposition. This means that there must be a strong appeal if government ownership is to be sold to the people. The most obvious appeal is price. Actually, in a country of such technological competence as ours, cost differences in power production, as between public and private development, in a given area, will be slight, provided all costs are included by each. With true costs the same, the only way an advantage can be shown for public power is by subsidizing it. Subsidy is, therefore, a political necessity, and our studies show that all Federal power is subsidized. The subsidy takes one or more of the following which are evidenced in lower power rates:

• **Use of interest rates which are lower than the actual cost of long-term money and risk capital.** The law provides that the Bureau of Reclamation include 3% interest in its rates for power from its projects. The practice is to include 2½% in the rates for energy produced at Corps of Engineers' projects. The TVA charges 4% to the Atomic Energy Commission, another Federal agency, but on the overall earned in 1953 and 1952 only 3.2% and 2.7%, respectively. REA charges 2% for the money it lends.

The average interest rate on the whole Federal indebtedness is approximately 2½%; but this is made up largely of short-term borrowings. For years there were no long-term borrowings. Long-term money has been obtained by the present administration through issues paying, most recently, 3% and as high as 3¼%. A return to the Treasury of less than 3% clearly involves subsidy.

The figures I have just recounted are a measure of the subsidy involved in the difference between what the government pays directly for money and what it charges its power activities for the same money. Actually the subsidy is greater. It is the difference between the cost of money and the amount paid for it by the power activities.

The real subsidy in the low interest rates can best be measured by the difference between the cost of money

Admiral Ben Moreell

in the open market for a specific kind of private project and the amounts charged by government to the same kind of public projects.

• **Omission of Federal Income Taxes or comparable contribution to the cost of the Federal Government.** No Federal income taxes are paid by Federal projects; and the supporters of the public power program argue that since there is no income from the projects, there should be no income tax. However, all costs of government must ultimately be borne by production. Wealth to support non-productive services is created solely by changing materials and energy to usable forms that are in demand. To exempt all or a part of any one form of production from its share of the cost of running the Federal Government—that is our national defense machine, as well as the continuing overhead costs of the executive, judicial and legislative branches — constitutes a subsidy to that particular item.

The Hoover Dam pays $500,000

You Can Take Action

1. Speak Out

Above all, I believe we should take a firm and uncompromising stand in support of our views. Each one of us who believes in the fundamental freedoms guaranteed to the individual by our Declaration of Independence and our Constitution in a government of narrowly restricted powers should lose no opportunity to make his views known in the hope that, if enough of us take such action, these vital matters will be brought to the attention of the thinking public.

2. Support Hoover Report

I am sure that the total of the Hoover Commission recommendations, if made effective, would constitute a great advantage to the nation.

It is my firm intention to do all in my power to mobilize effective public support for those recommendations of the Hoover Commission with which I agree. If this were done by all citizens, the result would be reflected in remedial action by the Congress.

annually from its revenues into a fund to finance Federal studies for the further development of the Colorado River. While it is not proven that this annual payment finances a sound activity, it can perhaps be argued that the amount involved is in some measure a payment to the Federal Government in lieu of taxes. But it is the only payment by Federal public power that can be so classed.

The full measure of subsidy through failure to pay taxes is not solely the amount of corporate tax foregone. The income earned by private investors in power projects is also subject to tax and this amount is also lost to the government in a power project. It is only partially offset by the taxes that are paid by holders of government securities.

A study of the 1953 financial records of the investor-owned electric utilities indicates that, on an average basis, stockholders and bondholders paid taxes equal to about 25% of those paid at the corporate level. At the top bracket level the ratio would have been nearer 38%. Roughly half of this would be offset by income taxes paid by investors in Federal Government bonds used to finance Federal public power projects. Thus, something in the neighborhood of $6.0 to $9.0 million which would have been paid by investors was lost to the Federal Government by reason of tax exemptions and Federal public power practices. Such a tax loss must be made up from other sources, and it constitutes another element of subsidy involved in the whole activity.

• With two exceptions (Hoover Dam and TVA), omission of state or local taxes.

Only two projects make payments in lieu of state and local taxes. The Hoover Dam pays a fixed annual amount to the states of Nevada and Arizona. The Tennessee Valley Authority pays amounts to the local government within its area in lieu of the taxes those governments would have received from TVA properties if they had remained in the state of their original acquisition by the Federal Government.

• Charging large parts of the initial capital costs to wholly subsidized Federal activities such as flood control, navigation, fish and wildlife, etc:

A few years ago a Congressional study gave considerable publicity to the difference in proposed allocations to power in the Southwest Power Administration area between, on the one hand, the figures of the Corps of Engineers and the Federal Power Commission as contrasted, on the other hand, with the figures of the Department of the Interior. In capital costs alone the Department of the Interior proposed charging some $200 million more to flood control, navigation, and other non-reimbursable items than did the other two agencies.

Excessive charge-off has not yet stopped. Under the general control of the Department of State a reservoir has been built on the Rio Grande in Texas and Mexico to provide flood control, water for irrigation, and hydroelectric power. As the United States' share, $5,872,165 has been allocated as the cost for 31,500 kw installed electric capacity. This is a current 1955 figure. It means an allocation of only $186 per kw as against current costs of $300 or more. This allocation includes nothing for the dam and reservoir but is limited to the cost of the power plant proper. Those other costs are charged to flood control and water supply, gifts of the Federal Government to the people in the area.

• Charging administrative costs, insurance, and pensions to other government accounts.

The Bonneville Power Administration includes in its energy rates a component to provide for miscellaneous administrative costs of the government that are not paid for directly by that agency. In no other Federal power project is there any attempt to provide reimbursement of the Federal Government for the costs involved in funding, auditing, insuring, or providing employee retirement. In general, there is no provision for meeting any of the administrative costs beyond those incurred for personnel directly assigned to the project or the costs of rentals and materials furnished by the General Services Administration.

Any one of these examples should show just why **no** private business can compete with a government business. A private entrepreneur must meet **all** costs. The government can always shift some costs to the general taxpayer. Under such conditions, fair competition is impossible.

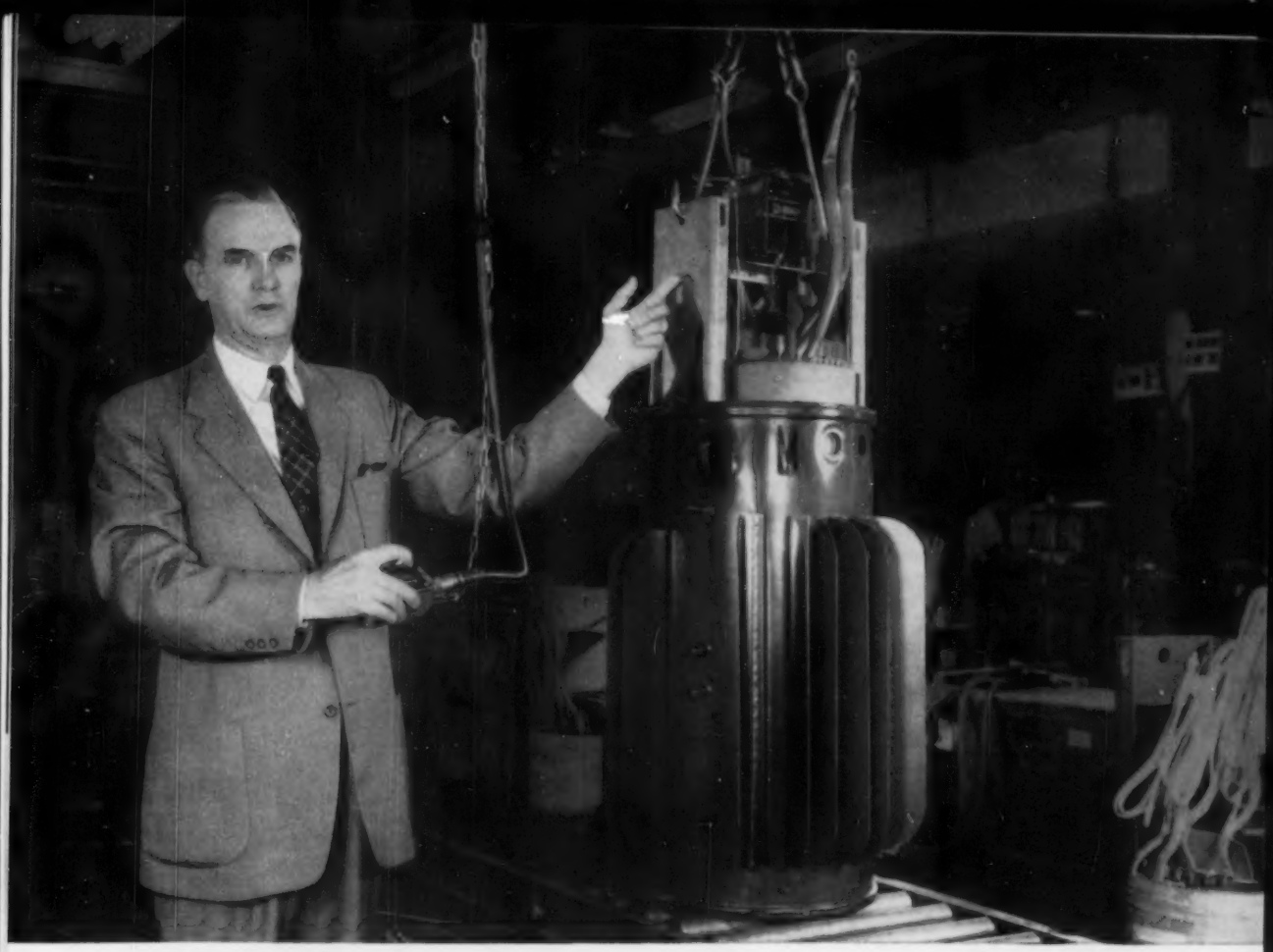
Accounting—Plain and Fancy

In addition to these obvious forms of subsidy, more obscure subsidy is introduced by what I call "accommodation accounting", ie, accounting which accommodates the wishes of those who desire to prove that public power is a blessing showered upon us like manna from heaven.

Now for a few brief examples of plain and fancy accounting. The Act authorizing the Hoover Dam provided that $25 million of the cost would be allocated to flood control and would be repaid without interest after the amounts allocated to power had been repaid. The law also provided that other amounts advanced for construction from the Treasury would be charged interest. When the amendatory Boulder Canyon Adjustment Act was put into law, it provided that for the purposes of accounting, the first $25 million advanced by the Treasury would be considered to be that allocated to flood control. In other words, the first money advanced, and the last to be repaid, would not bear interest. At a 3% rate this means that the annual interest load would be about $750,000 less than it might otherwise have been during the construction period.

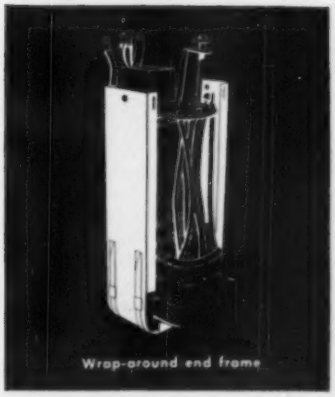
Size of Federal Power

Public power has become a potent and emotionally charged political issue. In 1933 the installed capacity of Federal power projects was less than 1% of all electric utilities in the country. By mid-1953 the Federal Government had invested $2.3 billion in power facilities and had become the largest single producer, accounting for 13.1% of the kilowatt hours generated. Federal projects now under construction and authorized will, by 1960, more than double the 1953 capacity and, when all are completed, will triple it, reaching a total of 35 million kilowatts, at a total cost of $10 billion.



B. S. Morris, Transformer Division, points out this

FACT: Wrap-around end frame adds strength and rigidity . . . simplifies maintenance



Wrap-around end frame

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YOU CAN BE SURE...IF IT'S

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Something super is performed in the accounting of the Cumberland River Projects. Here we have three dams built for flood control and hydroelectric power development by the Corps of Engineers on the Cumberland River. The Corps of Engineers has proposed allocating $120 million of the cost to power. The sales agency, the Southeastern Power Administration, has proposed to allocate only $103 million to this purpose. The Corps of Engineers has estimated the annual charge for power for the three projects at $5,112,000. The Southeastern Power Administration has made a comparable estimate of $4,134,000. The estimated average annual power benefits based on power values furnished by the Federal Power Commission are $11,540,000. The payoff comes in the next figure. The Southeastern Power Administration has contracted to sell the energy to TVA and estimates that the gross annual revenue will average $3,500,000. These figures indicate that the power will be sold for about 30% of its value and somewhere between 60 and 80% of its cost as computed by the agencies themselves! This cost, of course, assumes interest at no more than 2½% and makes no allowance for Federal, state, or local taxes!

Interest Component Gimmick

A more complicated accounting "gimmick" revolves around the so-called interest component.

The scheme was developed by the Department of the Interior in connection with the Columbia River Project. In brief, the net effect is to permit interest received by the Federal Government on the unamortized portion of investment allocated to power in a reclamation project to be applied to liquidation of costs allocated to irrigation rather than, as might be expected, returned to the Treasury as payment for the use of money. It is clear that this device provides a subsidy to irrigation. Some of the more naive have argued that the device does not provide a subsidy to power. However, the Director of the Power Division advocated approval of the interest component because lower charges could be made for both irrigation and power.

Data furnished our Task Force showed payout schedules for many projects still computed on the basis of using the interest component.

The most recent proposal of the Department has been to defer repayment of amounts charged to irrigation but beyond the ability of the water users to repay until after the amounts allocated to power have been repaid by power revenues. These deferred irrigation charges would then be repaid by power revenues. Remember, however, that the costs allocated to irrigation do not pay interest. Who, then, pays the interest during a long period of deferment? Correct, the general taxpayer!

The Mighty Preference

When the preference policy was first adopted there was very little difference between the tax burdens of privately owned and publicly owned utilities, and it made relatively much less difference if taxes were not considered as an element of cost in fixing rates.

Today, however, the cost of public power can be 35% to 40% lower than the cost of privately sold power if corporation taxes and taxes on the income from securities necessary to finance these projects are not taken into account. So we have an entirely different tax situation than when the preference policy was initiated, and its impact on power costs and rates cannot be ignored.

Starting in 1946 when all of the principal Federal projects were in operation, the preference customers took 38.3% of the power available to non-Federal users. This ratio steadily increased until in 1953 it was 52.2%. Meanwhile the privately owned utilities in 1946 received 33.3% of all the salable power from these projects and in 1953, 18.5%.

The trend toward increasing the supply to preference users has been accelerated in recent years. No firm power whatsoever will be available to privately owned utilities supplied by the Bonneville Administration in the Pacific Northwest after 1960 unless Congress authorizes additional projects, whereas in 1953 privately owned utilities received 33.3% of all power generated. Until recently, the Central Valley Project sold 95% of its output to California private utilities, but from now on practically all salable firm power will be delivered to preference customers, leaving the California investor-financed utilities with only the secondary power which such preference customers do not elect to take.

The preference policy in effect makes any consumer of a non-publicly owned utility a "second-class citizen" so far as Federal power is concerned. The company from which he buys power is denied Federal power. His neighbor across the road or in the next town served by a cooperative or a municipality gets power for less than true cost, and he, in his electric rate, pays local, state, and Federal taxes in a greater amount because his neighbor pays nothing toward these ends.

Thus does our Government openly and brazenly renounce any pretense of conforming to our traditional system of private enterprise in the field of electric power generation and distribution; instead, it charted a bold and ruthless course which could lead only to complete socialization of this basic industry!

An Evil Pattern

I believe that all public power which is subsidized by tax funds, whether on the Federal, state, or local level, is economically and morally wrong. Where a local community, or even a state, desires to indulge in such socialistic adventures, I deplore it greatly. In the field of morality, honest compromise is impossible. Where this solely is a matter of governmental and economic policies, I would say that the hazard of economic waste is not so great when state and local governments undertake such activities provided they pay all local, state and federal taxes. If their socialistic exactions become too onerous, many citizens will move out taking their wealth with them. But the Federal Government is in competition with no one. It is an all-powerful monopoly with unlimited taxing power, plus the power to devalue the currency by issuing printing-press money.

Federal power sets an evil pattern for all other segments of the economy to indulge in self-seeking competition for government handouts. These handouts are bought with votes; and when votes are thus prostituted, freedom is endangered.

Perhaps you will conclude from the foregoing that I do not believe in public power. If so, you are absolutely correct!

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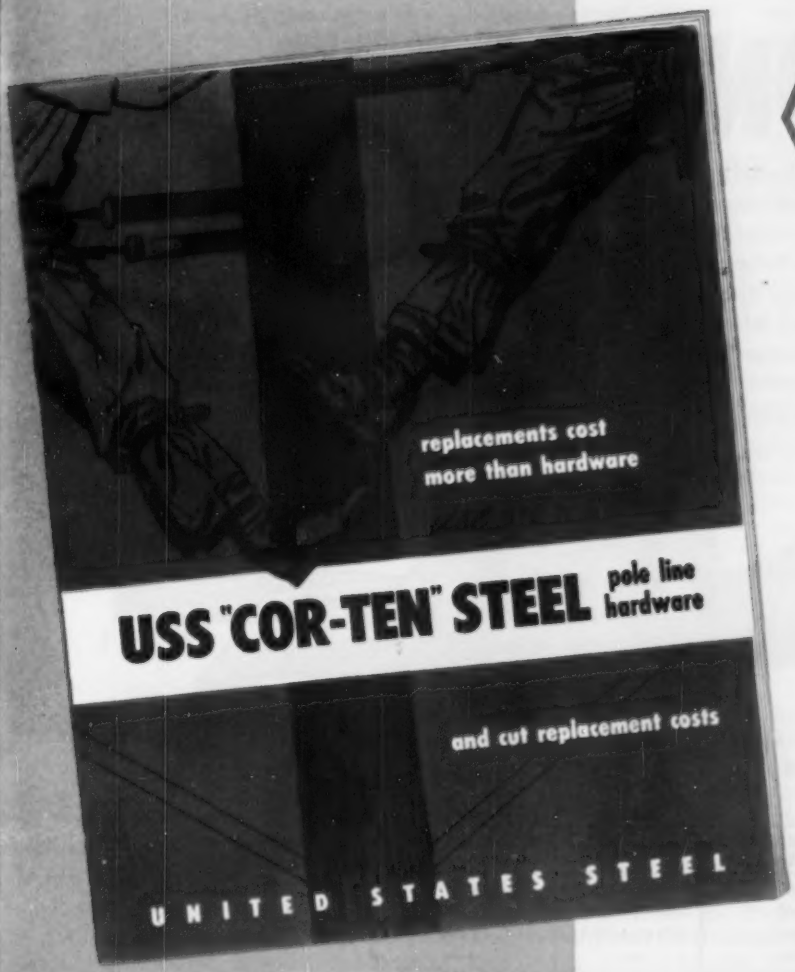

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350 Mcm	5,000	336.4 Mcm (18-1)	5,500
500 Mcm	7,600	477 Mcm (18-1)	7,700
1000 Mcm	10,000	—	—

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Distribution Trends Spotlighted

. . . by second GE conference for utility engineers; future load growth forecast despite decline of new families being formed

Future utility load curves will be shaped like today's, but will be plotted at higher levels. However, the number of new families being formed is not increasing now as rapidly as it did prior to 1951. This break in the customer growth curve should continue until 1965.

These were two observations aired at a week-long conference on distribution system planning held by General Electric Co.

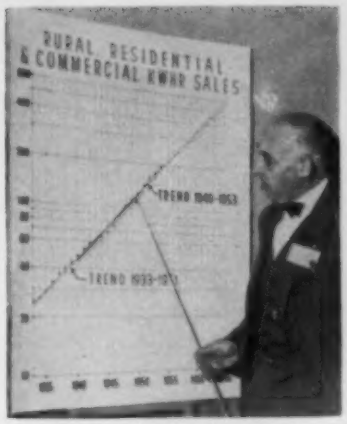
Problems of Growing Demand

Attended by 31 utility delegates from all parts of the country, including the Quebec Hydro-Electric Commission and Canadian-Brazilian Services, Ltd, the conference raised for discussion the problems of a growing electrical industry. As a result, it was hoped that both utilities and manufacturers could plan for the future with more precision.

During the week-long session, which was held this month, the group toured GE's turbine factory and research laboratory at Schenectady, N. Y., the distribution transformer plant and sound laboratory at Pittsfield, Mass., and the capacitor plant near Glens Falls, N. Y.

Other conclusions and observations made at the conference included:

- The farm load is considered by some utilities as almost in the same category as industrial because of its constancy and because so much depends upon service continuity.
- Self-protected transformers, now given basic settings of 100% with emergency settings of 115%, may soon get basic settings of 115% and emergency settings of 130%. This means shorter transformer life, but utilities have requested this change.
- The utility's concept of transformer overloading has changed in 20 years. Formerly transformers were overloaded to 167% rated kva; now they are overloaded to about 137%. If load peak comes in summer, utilities will drop to an even lower figure because of higher ambient temperatures.
- There is a definite trend toward distribution transformers equipped with some form of self protection.
- Although commercial air conditioning dominates today, some utilities are discovering small residential peaks on their load curves. Flicker is a problem, but as saturation approaches 80%, flicker will disappear as it did when refrigerators became common household appliances.
- Long-range system planning—usually hard to accomplish because of pressing problems at hand—can be insured by expert deployment of engineering talent. One utility uses high school girls to run routine calculations so engineers can devote more time to important planning.
- Transformer trends are toward three-phase substation units instead of single-phase banks.
- Repetitively manufactured transformers are growing in popularity. They offer an 8% cost reduction over non-standard units. So far, repetitive transformer manufacturing has saved the entire industry $12- to $15-million.
- With the electric industry load expected to double in 10 years, utilities are using more high primary distribution voltage. But one company already is reaching a thermal limit on some 12-kv lines feeding heavy load areas.
- Trends also point to higher secondary voltage—either 277/480 or 265/460. Merits of both systems are still being hashed out.
- Three-phase secondary systems seem unlikely for residential areas.
- Hermetically sealed transformers are desirable if price can be held down and if bushings either can be kept from breaking or can be repaired in the utility's workshop.
- Distribution transformers today were looked upon as compact enough for the job. Utility engineers now feel manufacturers should go after coil losses. Last year, utilities felt size and weight reduction was preferable to loss reduction.



GE's H. M. Jalonack discusses future power consumption at distribution meet

FPC Sees 350% Power Demand Rise

The Federal Power Commission predicts a 350% rise in the demand for electricity over the next 25 years.

A new FPC report, "Estimated Future Power Requirements of the United States by Regions, 1954-1980," forecasts annual electric energy requirements of 1,696-billion kwhr in 1980, compared with 478-billion kwhr in 1954. Peak loads are expected to hit 312-million kw, a rise of 222-million kw from last year's 90-million-kw capacity. (In its forecast issue, Sept. 19, EW predicted total sales would rise to 1,258 kwhr by 1970.)

The report, available at FPC at 20 cents a copy (order number: FPC P-29), covers all electric utilities in the United States. It says energy requirements and peak demands are expected to grow at about the same rate, with slight load-factor rise.

Loads in the South and Southwest will grow faster than the national average, as they have been doing. Due to continued influx of heavy industry, the Pacific Northwest is expected to add more and more power capacity, once again surpassing the national average in electric growth. Considerable industrial expansion in the Pacific Southwest is expected to add to demand more than the national average.

For residential loads, FPC predicts a rise from 2,500 kwhr per home in 1954 to nearly 6,500 kwhr in 1980, with wide variations by region. Industrial use is expected to continue to account for almost half of total energy sales. Commercial use, now almost one-sixth of kwhr sales, is expected to show substantial growth.

MUSHROOMING LOADS like this all-air-conditioned department store at a new Levittown shopping center have created a load growth problem for the Long Island Lighting Company.

How Long Island Lighting Pares Cost of Future Secondary Network System

TREMENDOUS EXPANSION of both residential and commercial building load on Long Island makes it necessary to plan far ahead. A secondary network seems to be inevitable in some of the newer commercial areas serviced by the Long Island Lighting Company of Mineola, N. Y. Recognizing this problem, Long Island Lighting is already planning on how to cut costs of its *future* network system.

Even though new areas are still served by a radial system, the utility is installing G-E *network* transformers to handle concentrated loads in new shopping centers, like the all-air-conditioned department store at Levittown. When a secondary network becomes necessary, many of the vaults will already be equipped with network transformers and only network protectors will have to be added . . . giving a considerable saving on ultimate installation and rearrangement.

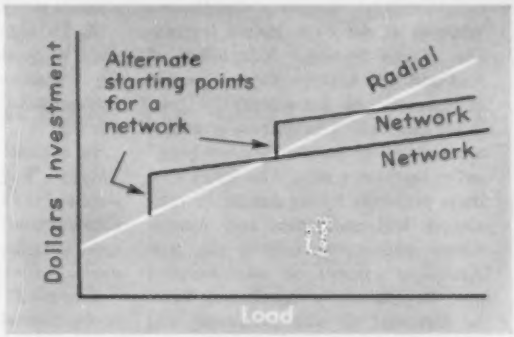
OTHER BENEFITS come from this advanced planning. Congested overhead wiring is eliminated. Better service continuity results from underground service. Greater dependability is obtained from submersible G-E network transformers . . . with their new panel-type radiators that minimize corrosion and facilitate maintenance, and particularly cleaning and repainting.

HELP FOR YOUR SYSTEM. If you are planning to meet continued load growth with a radial system and your load density can be expected to reach 50 to 100 kva per 100 feet of street within the next ten to fifteen years, now is the time to investigate the advantages of a secondary network.

G-E district engineers will be glad to help you compare the costs of your present system and the potential savings possible with a network. For full details, write to Section 435-9, for Bulletin GET-2432. General Electric Company, Schenectady 5, N. Y.

FUTURE CONVERSION TO NETWORK SYSTEM is facilitated by the installation of this G-E network transformer with "panel-type" radiators. When the secondary network system becomes a reality, the only additional equipment necessary will be the installation of network protectors.

PLACED IN AN HOUR under the shopping-center parking lot, this 1000-kva 13,200–216Y/125 unit can weather submersion if lot should become flooded.



IT PAYS TO START A NETWORK. Future increases in capacity require less investment with a network. The sooner it is started, the lower the ultimate cost.

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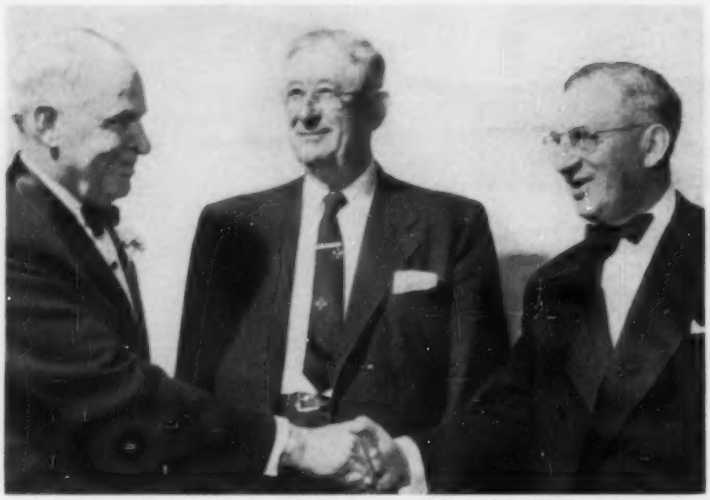


NARUC'S newly elected Pres Benjamin Feinberg (r) is congratulated by North Carolina Gov Luther Hodges (l). John C. Hammer, first vice president, looks on

Regulatory Changes Charted

NARUC convention recommends changes in Federal Power and Public Utility Holding Company Acts, elects new officers

Men and women possessing the highest degree of character and ability will be demanded in the future by regulatory bodies. This was a statement made by outgoing Pres W. F. Whitney at the 67th annual convention of the National Association of Railroad and Utilities Commissioners in Asheville, N. C., recently.

He said that "Challenging problems are and will be constantly developing" in the regulatory field. The solution of these problems by regulation, he continued, will need men and women whose philosophy reflects the true American concept of administrative law. Regulation, he concluded, "must be animated by such personnel, and ideals, if it is to function fairly or survive permanently."

The special committee on legislation amending the Federal Power Act reported that after a meeting with representatives of the Federal Power Commission a bill (H.R. 7468) was introduced in Congress which has three objectives:

1. To amend Section 10(f) to provide that charges shall be paid by federal power projects which are benefitted by upstream improvements constructed by other parties.

2. To amend Section 10 to increase the standard for waiver of license from 100 hp capacity to 2,000 hp capacity.

3. To clarify the take-over provisions in Section 15 so as to establish the preferment of the holder of the license at the time of expiration of the license.

In a panel discussion on "Nuclear Energy", Ray E. Untereiner, commissioner of the California Public Utilities Commission, warned "It is not too soon to undertake the development of nuclear power."

Edward R. Thornton, commissioner of the New Hampshire Public Utilities Commission, discussing the legal, health, and safety problems arising out of industrial nuclear use, said, "We must examine our respective state statutes with a view of making certain they allow the proper regulation by our agencies of an atomic reactor operated by an electric utility within our jurisdiction."

John H. McCarthy, chairman of the Michigan Public Service Commission, told the panel it is his opinion that "the advent of the atom has not affected the fundamental principles of rate making. However, a serious factual question is presented in the evaluation of what determines operating expenses in contrast with capital charges during the research and development period which lies ahead for perhaps the next ten years."

It has become very apparent, he said, that "until facts are established there is no absolute yardstick to offer" in the business of "accounting" as regards nuclear power plants which may be constructed.

Depreciation Group Reports

The report of the Committee on Depreciation on liberalized depreciation was not officially adopted as an expression of NARUC policy. For all that, it makes interesting and important reading to the utility industry, especially since the possibility of subsequent adoption of the theories, either in whole or in part, which this report propounds, cannot be overruled.

The report said, in reference to liberalized depreciation, that "The purpose of Congress was . . . to allow all persons investing in new depreciable business property—farmers, merchants, manufacturers, professional people, etc — to use depreciation methods which Congress felt conform more closely to economic facts in most situations.

"There is no evidence that Congress intended to furnish a part of proprietorship capital to all investors in new depreciable property. It merely authorized as beneficial the adoption of recognized methods of calculating a large item of business expense for tax purposes."

What Congress Intended

The committee, in its conclusions, noted that "There can be no doubt that Congress intended to allow all persons investing in new depreciable business assets after Dec. 31, 1953 more liberal deductions for depreciation expense in the determination of taxable income. The allowance of more depreciation than is reflected by the straight-line method was considered to help mitigate the risk inherent in investment in depreciable facilities by permitting more rapid recovery thereof, thus permitting quicker reduction in debt, aiding in the financing of new plant, or making more working capital available, and at the same time conforming more nearly with the ac-

(*Continued on page* 63)

Specially shaped porcelain disk, flashing over at 67,500 Volts

The Shape of Things to Come

Coming...440 KV...500 KV transmission systems!

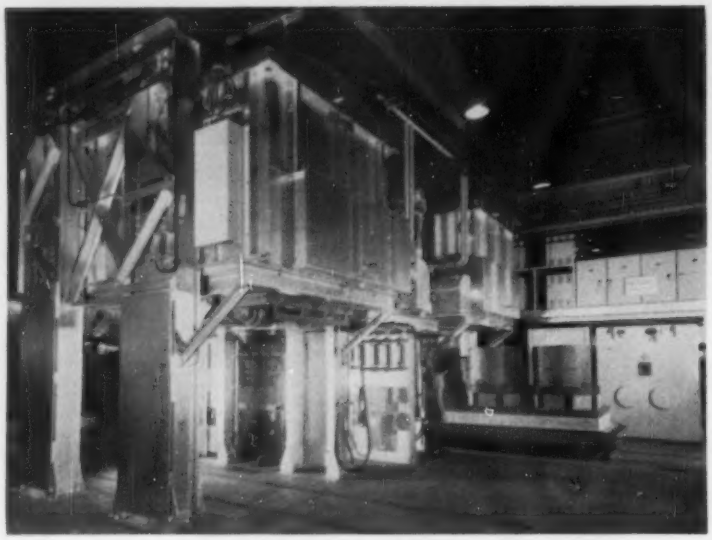
Who knows how insulators will behave at such voltages? Is it possible that presently accepted insulator shapes should be revised in view of special demands made by voltages of 400,000 and up?

It's our job to find out . . . and that's what we have been doing in our High Voltage Laboratory. In this case, we are re-examining the whole concept of insulator shape.

We are asking ourselves this . . . and many other provocative questions, as part of our constant search for new information on high voltage insulation problems. It is part of our service to the electric power industry.

LOCKE

LOCKE DEPARTMENT
GENERAL ELECTRIC COMPANY
BALTIMORE, MARYLAND



A-C Starts Steel Annealing Furnaces

Six elevator-type electric annealing furnaces have been placed in operation at Allis-Chalmers Manufacturing Co's Pittsburgh (Pa.) Works for heat treating semi-processed transformer core steel.

Each of the 15-ton, 360-kw furnaces heats the steel for several hours around 2,000F in a controlled hydrogen atmosphere. Coils of core steel are placed in retorts on cars and hoisted into the furnaces. Heating and soaking operations are instrument controlled. Upon completion of the treating cycle, the loaded car is removed and a hood is placed over the steel for careful cooling.

Important to this processing of core steel is the new gas-generating plant which produces hydrogen and oxygen by electrolytic dissociation of water. In the annealing process nitrogen is first introduced to eliminate all oxygen. It surrounds the steel for a specified period. Hydrogen is then admitted to purify the steel in the solid state.

Illustrated are two furnaces with electric control panels, 60-kw saturable core reactors and 230-v, 900-amp magnetic contactor on the mezzanine, and on the floor the 750-kva, Allis-Chalmers dry-type transformer with air interrupter switch. Each transformer supplies power to two furnaces.

Square D, EC&M Negotiate Merger

Square D Co, Detroit, and Electric Controller & Manufacturing Co, Cleveland, recently announced plans to merge.

The two firms "reached an understanding in principle" on a merger, according to F. W. Magin, president of Square D, and A. G. Patterson, EC&M president. Completion of negotiations depends on the action of directors and stockholders of both companies.

Decisions of the two boards will probably be made public in about two weeks, according to an informed source, who predicted that there would be no opposition to the merger. It is quite possible that EC&M will emerge as a division of Square D, the source declared.

The proposed merger seems designed to diversify Square D further by putting it into the field of control apparatus for heavy industrial machinery. Square D makes electrical distribution and control equipment. EC&M turns out equipment such as automatic motor starters, crane and material handling controllers, lifting magnets and magnetic brakes.

Under the merger terms stockholders of EC&M would receive 1½ shares of Square D for each EC&M share. Electric Controller has 212,565 shares outstanding.

In the first nine months this year Square D had sales of $49,417,000 and EC&M $6,431,000.

The firms have parallel operations in U. S., Canada and Mexico.

Bodendieck Tool Stock Purchased by Tipsord

Outstanding stock of Bodendieck Tool Co, Taylorville, Ill., has been purchased by Clyde Tipsord from H. W. Bodendieck, president. The company manufactures live-line tools and specialties.

Tipsord was employed in the live-line tool department of the James R. Kearney Corp for 22 years. His father, known to the people of the industry as "Tip," was co-founder of Tips Tool Co in Taylorville in 1925. This latter company was absorbed by the A. B. Chance Co, Centralia, Mo.

Design File Purchased by Precision Transformer

Precision Transformer Corp, Chicago, has purchased an engineering and design file from Stockwell Transformer Corp, formerly of Akron, Ohio. The data covers liquid-filled and air-cooled transformers up to 3,000 kva.

Acquisition of these field-tested designs, reports Precision, will enable the company to manufacture a complete line of liquid-filled and dry-type transformers. The new liquid-filled units will be 10-3,000 kva up to 46 kv.

Anaconda W&C Uses Non-Returnable Reels

Non-returnable reels are being used by Anaconda Wire & Cable Co in shipments of certain types of wire and cable.

At first the program will be generally confined to shipments of build-

(*Continued on page* 59)

THE SANGAMO J2

. . . your best investment in watthour meters!

Here are the features which give the Sangamo J2 long, trouble-free service life . . . features which make the J2 the best investment you can make in watthour meters:

ACCURATE MEASUREMENT TO 100 AMPERES without sacrifice of performance at light loads.

LIFETIME BEARING SYSTEM. Proved by millions of Sangamo Meters in service up to twenty years.

HIGH INSULATION LEVEL to withstand high-voltage surges without damage.

HIGH DRIVING POWER . . . accuracy not affected by friction caused by foreign matter even down to the lightest loads.

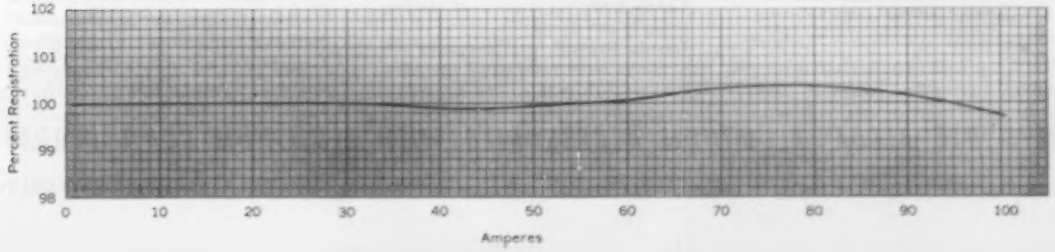
CORROSION-RESISTANT FINISHES AND MATERIALS for optimum performance in humid, salt-laden or corrosive industrial atmospheres.

PLUS SLOW SPEED!

At full nameplate rating, the J2's disk makes only 10 revolutions per minute. *This is many times slower than the disk speed of any other watthour meter on the market today.* And slow speed, which results in less wear on moving parts, is one of the big reasons why the J2 lasts longer . . . gives you more years of trouble-free service.

SANGAMO ELECTRIC CO.

SPRINGFIELD, ILLINOIS



JM55-8

This ASQC Test Safeguards every inch of ALCOA ACSR*

Your Guide to Aluminum Value

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS

*ASQC—Alcoa Statistical Quality Control—a recognized standard of excellence in the aluminum conductor industry.

Every time we break a strand of ACSR (. . . and we do it many times a day, as part of a continuing production check for quality), we're making certain that a strand doesn't break after you put it in service.

But that's only one of many checks we make. The list of tests is unmatched in the industry. It includes:

Metallurgical Specifications—quantometer tests on each pour of rolling ingot.
Uniformity—systematic checks for dimension and surface quality during fabrication.
Conductivity—to assure peak carrying capacity per pound.
Tensile Strength—to safeguard satisfactory service under all operating hazards.
Elongation—to insure adequate ductility.

This Alcoa Statistical Quality Control program is unique, an exclusive service. Detailed test records are on file at each plant.

It's a plus value that costs you nothing more. No wonder independent surveys conducted for the past ten years show Alcoa to be top choice of T & D users.

Your local Alcoa electrical conductor salesman stands ready to give you expert engineering assistance in solving your problems. Call him—or write direct to Aluminum Company of America, 2313-Y Alcoa Building, Pittsburgh 19, Pa.

ALWAYS USE ALCOA® ALUMINUM ACCESSORIES WITH ALUMINUM CONDUCTORS!

Non-Returnable Reels

(*Continued from page 56*)

ing wire items to distributors' stocks and to shipments of aluminum insulated and covered conductors. Ultimate scope of the new program will be dictated by experience, the company reports.

During the past year Anaconda W&C's non-returnable reels have proved adequate for commercial shipments to all sections of the U. S.

Aluminum Coils Ordered For Alcan Transformers

Aluminum Co of Canada Ltd recently ordered three, single-phase, 71,000-kva transformers for its Alcan Project at Kemano, British Columbia. The transformers, to be built by Ferranti Ltd, will have aluminum windings.

All three units, with high-voltage ratings of 301.4 kv, will form a 213,000-kva bank of generator transformers. Including this order, Ferranti is supplying 13 transformers for Alcan. Total capacity is 648,000 kva.

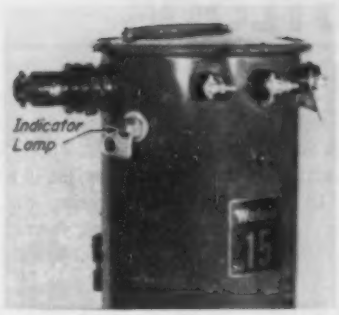
Atomic Steam Generator Planned by Norway

The Norwegian-Dutch Joint Establishment for Nuclear Research has drafted plans for a project atomic steam generator. The reactor, which will be built into solid rock, is designed to generate a minimum of 10,000 kw of thermal energy.

The purpose of the project is to develop an atomic generator for marine propulsion and for electrical generation in certain power short industrial areas. The project is scheduled to be built during the next two years.

Sylvania Plans Tube Plant

Sylvania Electric Products Inc will break ground soon for a multi-million dollar plant at Altoona, Pa., according to Matthew D. Burns, vice president-operations. The new 110,000-sq ft single-story plant for the production of receiving tubes will be built on a 15-acre site.



Overload Indicator Added to Wagner Transformers

An overload indicator has been introduced by Wagner Electric Co for use on oil-filled distribution transformers 15 kv and below, 3 to 100 kva, single-phase, and 9 to 150 kva, three-phase.

The Wagner winding-temperature overload indicator is actuated by copper temperature and designed to warn of the approach of dangerous overloads. Its use provides a loading guide for distribution systems that feed rapidly growing residential and small industrial loads.

A thermal element is embedded in the transformer winding to control the indicator. When the element is heated by an overload to a predetermined temperature, it actuates a switch to light the warning lamp mounted on the transformer tank. Lamp stays lit until turned off by external handle operated by a hot-stick.

F-W Steam Generator Ordered by Union Electric

A dual circulation reheat steam generator was ordered recently from Foster Wheeler Corp by Union Electric Co of Missouri. H. B. Wallace, Jr, manager of steam sales for Foster Wheeler, said that the utility ordered the generator for Unit No. Three at its Meramec Plant.

The steam generator will have a maximum continuous capacity of 1.85-million lb of steam per hour at 2150 psi and 1010F with reheat to 1010F. Fuels will be bituminous coal pulverized in three Foster Wheeler ball mills and natural gas.

The equipment is scheduled for operation the latter half of 1958 and will add 250,000 kw to the Union Electric system.

M&M BRIEFS

Infraglass Heater Co of Pontiac, Mich., has added two new lines to its line of electric radiant heating systems. The new lines are a series of convection-type heaters and electric cables. They will be marketed under the trade names of Infraair and Infracable, respectively, through the company's distributors.

J. H. Baxter & Co, producer of pressure treated forest products, has moved to a new home office in the Equitable Life Insurance Co building at 120 Montgomery St, San Francisco, Calif. The main sales office and all accounting and bookkeeping offices have been consolidated in the new headquarters.

E. I. du Pont de Nemours & Co, Inc has announced plans to construct a plant for the manufacture of "Hypalon" chemical rubber. The product is a synthetic rubber which is reported to offer outstanding color stability and resistance to heat, chemicals, oxidizing agents and weather. The plant is scheduled for completion early in 1957.

Bogue Electric Mfg Co, Paterson, N. J., has designed and built two large static selenium rectifiers, each rated 480 kw, for the Atomic Energy Commission installation at Paducah, Ky. They will be furnished through Union Carbide Nuclear Corp and used to supply d-c power for depolarizing large electrolytic cells for fluorine production.

Bailey Meter Co, Cleveland, Ohio, has purchased the Cities Service "Heat Prover" combustion analyzer for oxygen and combustibles in flue gases. This portable testing device will be manufactured and sold by Bailey. However, Cities Service has retained the right to continue analyzer loan service to the users of its petroleum products.

General Electric Co's first commercial version of a microminiature ceramic tube, a shirt-stud-size device destined to bring UHF television within the range of thousands of heretofore "televisionless" homes, was announced by the tube department at Fort Worth, Texas. Titanium and special ceramic insulators make up the body of the new tubes.

BUSINESS OUTLOOK

Electrical World
NOVEMBER 21, 1955

The outlook in brief: **The outlook for next year has changed. Before, it was good. Now, it's wonderful! The good news comes from business plans for capital spending** in 1956. This year such spending is at record peacetime highs. **Looks now as if next year it will be 13% higher.** Add this to higher public spending on roads, schools, etc., plus, probably, hefty tax cuts in an election year, and you have the makings of a man-sized boom—maybe even a bout of inflation.

The glad tidings about business investment are in the new McGraw-Hill Survey of Business Plans for New Plants and Equipment, reported last week in E.W. This Survey is based on a good sample: firms covered hire a third of all industrial workers. It has proved a reliable indicator so far, not only of investment but of prosperity generally. And the hopeful results this year are backed up by plenty of other signs pointing the same way: big new machinery orders, for example, the rush on industrial building permits, and the tightness in steel deliveries.

If business follows through on present plans, **next year will see a step-up in business capital investment by $4 billion.** To this you can **add at least $1.5 billion for urgently needed roads, schools and hospitals.** This is partly offset by an expected fall-off in new housing. But even pessimistic builders don't expect housing starts to be down by more than 15%. Allowing for higher building costs, and bigger and fancier houses, this would cut housing investment by less than $2 billion. So total investment expenditures will be up sharply anyhow—and if they're not up **enough** you can count on the government to relax credit terms again.

Capital spending is **dynamic: it creates activity in many other sectors. For one thing, you can expect a continued buildup of inventories** which are still not too high in relation to sales. **For another, you can be pretty confident consumer income will keep rising**—what with full employment, lots of overtime, wage increases, higher minimum wages, more liberal social security benefits, and higher farm prices.

With rising consumer incomes you normally get rising sales. **Two question-marks next year are consumer credit and auto sales.** These are closely related: most of the new cars have been sold on time. The auto industry's hope of selling another 7.5 million cars next year looks optimistic, particularly if there's to be some curb on the rapid climb in consumer credit. Sales of soft goods are less affected by credit conditions.

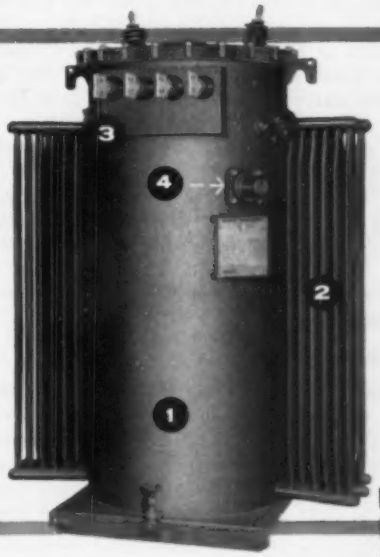
Even with less reliance on consumer credit next year, tax cuts may still enable the consumer to increase his buying. Looks now as if the government's administrative **budget will be in balance,** and the cash budget (which includes social security taxes and expenditures) will show a tidy surplus. **You could hardly avoid substantial tax cuts in an election year, under such conditions.** And with record-breaking profits in 1955, you'll likely see some strong demands by the unions for wage increases next year. **All in all, consumer buying power promises to be high enough to support expanding markets in 1956.**

If the investment plans reported in the Survey are carried out, industry's **power requirements will mount a lot faster than previously expected.** The power industry still has a comfortable gross margin. **But it may have to review its own planned investments for 1957 and 1958** in relation to the new speed-up in industrial growth.

Wagner Form W Distribution Transformers

available in ratings through 500 kva

Enthusiastic acceptance of Wagner Form W Transformers over a period of five years has led Wagner engineers to incorporate the Form W design in ratings of 250 to 500 kva. Wagner Form W Construction in these ratings means a lighter, more compact, easier-to-handle transformer.

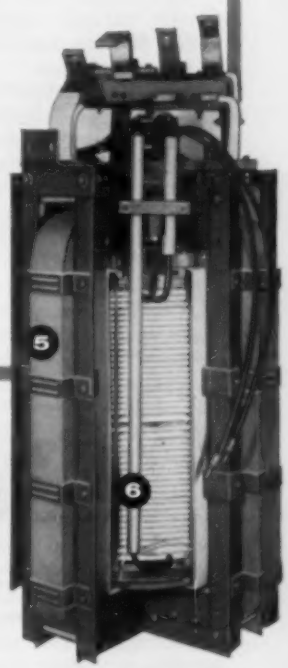


1 HOUSED IN ROUND TANKS . . . inherently strong . . . compact . . . light in weight.

2 ELLIPTICAL TUBE RADIATORS for efficient cooling . . . provide maximum radiating surface in minimum space.

3 LOCKED TANK WALL BUSHINGS . . . each provided with a groove to match a key in the mounting hole of the tank wall . . . bushings are securely locked, cannot turn.

4 WEATHER-PROOF, TAMPER-PROOF TAP CHANGERS . . . operating handle is protected by cover which shows tap position . . . can be padlocked.



5 CORES are of cold-rolled, oriented grain steel, wound through and around the coils. In ratings from 250 to 500 kva, there are 4 core sections spaced 90° apart.

6 WINDINGS . . . high voltage and low voltage coils are wound on insulating cylinders of high mechanical and dielectric strength . . . the winding best suited to each transformer's rating, voltage and current is used.

Choose Wagner Form W Transformers for your next distribution transformer installation—they pay dividends in longer service life.

Wagner maintains a nationwide organization to provide fast, convenient service with branches in 32 principal cities. Bulletin TU-180 gives complete information on Wagner Distribution Transformers —write today for your copy.

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

T55-15

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC

IN THE INDUSTRY

Utilities Need a House Heating Policy

Unless they want to be caught in another kind of heat storm, power suppliers must take the lead in furnishing information and guidance on space heating

If nothing else, Electrical World's house heating report of last week hoped to make one very realistic point: The heating of homes electrically is with us and with us in such strength that it well could move on and leave us, like air conditioning, in the caboose instead of the engine.

Heartened manufacturers and their dealers, utility help or no, are charging after sales with new confidence. And more and more customers are finding their way to utility offices loaded with interest and questions.

Do you know what to tell them? More important, do your employees know what to tell them?

An electric equipment distributor, just for kicks, recently dropped in on a utility's retail sales floor and, without identifying himself, asked a salesman what it might cost to heat electrically a three-bedroom home. The salesman answered quite frankly that he didn't know, but it would be "terribly expensive . . . somewhere in the neighborhood of $2,000."

Lack Information and Policy

The distributor knew better. The cost actually is closer to $400. But even a utility not after the load can ill afford to have its representatives overstate the price of its service by four or five times.

Yet you can't blame the salesman. The utility admits that the customer could have been talking to any one of a number of people within the organization.

Even more sad, this same thing could have happened at many another utility. When it comes to electric house heating, utility employees appear to be just as uninformed as their customers. And lack of knowledge leads to confusion.

Pros and cons fly back and forth. Do we push it? Do we, don't we have special rates? What will it cost? Do we have insulation standards? What about thermostats and layout? Questions and contradictions fog the atmosphere, and everyone—manufacturers and dealers as well as employees and the public—end up very much in the dark.

Complained one manufacturer: "We never know what to expect when we make lots of our utility calls. It all depends on whom we talk to. One fellow tells us one thing; then his boss comes along and cancels him out."

Policy indeed is needed; a clear, precise statement from each utility of the position it takes on electric house heating.

Some already have done this and find it essential in clearing the air and setting the record straight.

Georgia Power Co, for example, issued this policy statement to its sales personnel:

1. Become well informed and have full knowledge of all kinds and types of electric space heating equipment.

2. Become familiar with, and able to figure heat losses. Have a knowledge of insulation and capacity required.

3. Be able to discuss heating intelligently with customers and furnish advice.

4. Be prepared to tell the customer where and how he can get the equipment and have it properly installed.

5. Be prepared to promote the use of electric space heating in new homes where air conditioning is being installed, and thus secure a year-round load rather than a seasonal one.

6. Promote the sale and acceptance of the heat pump through established distributor and dealer channels.

7. Develop ways and means of selling supplemental electric heating in those locations where air conditioning already is installed and capacity to serve the load already exists.

The company then backed these directives with a program of informational activities.

Study Must Precede Policy

Georgia Power's statements came only after a conscientious study of the load and some rough sailing itself on the tide of house heating relations. Utilities which have not yet done so owe it to themselves to take similar action: Conduct a close examination of the house heating facts as they apply to their own systems, and then let their stand be known.

Then and only then can the propagation of the all-electric home proceed in an orderly manner and sales efforts reach their effective maximum.

TECHNICAL NOTES

Synchronizing pulses synchronized with the crest of 60-cps test voltage improve "radar" methods for locating faults in cable, particularly when fault is not submerged.

Time delay of 30 sec in the tap changer of a unit substation limits tap changes during feeder reclosing almost as effectively as a blocking circuit. Difference is only two tap changes for three reclosures on the 0-15-30-sec sequence.

Mercury lamps for street lighting give twice the life and up to three times the lumens of incandescent units.

Quick thawing of ice on overhead conductors is most economical because it minimizes heat lost to the atmosphere.

Poles resist wayward autos with devastating effect on both. An Indiana co-op has requested drivers to steer between poles when they leave the road.

Regulatory Changes

(*Continued from page 54*)

tual occurrence of depreciation for many classes of property."

However, having stated the foregoing worth-while objectives, the committee immediately and effectively negated them by the statement that "In general this committee favors the computation of depreciation expense for public utility accounting and rate purposes according to the straight line method and the recording of income taxes each year at the actual tax liability for that year."

Depreciation Expense Endorsed

The report went on to say, "However, if by reason of the provisions of the Internal Revenue Code of 1954, an additional expense allowance is made by regulatory commission, it is recommended that the allowance should be recorded as depreciation expense—the item with which Congress was dealing. In this way there will be a balancing of interests in that the customer will pay more for depreciation expense but in return will realize an equivalent credit in the rate base. The treatment would, in effect, charge the customer more rapidly for the cost of plant consumed but would give him pro tanto credit through reduction in the rate base. This would be fair treatment—fair alike to the utility and the customer."

The fact that the foregoing treatment substantially removes all of the benefits which Congress intended all investors to have, as well as introducing elements of discrimination as between present and future customers, has apparently been over-looked by the committee.

Valuation Committee Report

The report of the Committee on Valuation noted that "The failure of price levels to fall during the 1953-1954 drop in business conditions supports the position taken by many economists that the 1940-1952 increase in prices has become permanently embedded in the economy, and that a new plateau of prices has therefore been reached."

The report continued "Whether or not prices remain on the present high plateau or are going to increase further, the regulatory problems associated with increasing unit costs are going to require careful consideration in utility valuations. These problems will be with us for many years or so long as new units of property cost more than the average cost of existing units of property. There is a double-barrel effect caused by the increase in the rate base arising from the increased investment per unit of property and by the decline in earnings arising from the higher expenses directly associated with such increased investment."

Fair Value Cases Cited

The report mentioned briefly some of the more important fair value decisions. Among these were the Central Maine case which said, among other things, that "The Court did not believe 'that an increase over original cost depreciated barely over 3% is an appreciable reflection of the impact of inflation upon values'."

The report also noted that "In New York late in May the Appellate Division of the State Supreme Court by a 3-2 margin annulled commission orders denying a rate increase which had been requested by the New York Telephone Co on the grounds that the commission had erred in refusing to accept evidence as to the current value of the company's property. The Court ordered the matter remanded to the commission. The New York Commission has announced its intention to appeal this case to the New York State Court of Appeals."

Inflation Factor Considered

Another decision of considerable importance to all utilities was that of the Diamond State Telephone Co wherein the Supreme Court of Delaware, in its revised opinion ". . . held that the fair value determination by the commission which equated to approximately 112% of net book cost did not give sufficient weight to reproduction cost in the light of the evidence of present inflationary conditions."

As to accelerated depreciation, the committee report took a position seemingly opposed to the Committee on Depreciation when it said, "The intent of Congress of providing capital for expansion would be defeated if utilities were permitted to disburse the tax reduction to their stockholders or required to pass it on to their rate payers.

"The retention of the tax reduction as a source of capital would be accomplished by a reservation of surplus or a reserve for taxes. If reserve accounting should be the ultimate answer, the reserves that will be created may require consideration in connection with rate case valuations. Until the matter is further clarified, it would seem desirable that the state commissions defer taking any final stand resulting in the establishment of a general binding precedent."

Rate Committee Report

The report of the Committee on Rates of Public Utilities, while it subscribed fully to the original cost rate base, took exception to certain of the adjustments made by commissions in original cost jurisdictions, such as the year-end rate base, by saying "It would, on the surface, appear to be perfectly proper to use for rate case purposes a valuation based on end of period figures, since such plant is actually in place at the time of the hearings. On the other hand, there are no firm figures available for utility earnings except those accumulated during the test period, and the only logical figures to use as a rate base in conjunction with such earnings would be the average plant during the period. Consequently, it would seem somewhat arbitrary to use end-of-period investment figures in this determination."

As to accelerated depreciation, the view was expressed that utilities should be allowed to maintain the benefits of the temporary tax deferral. This view would appear to be in opposition to the one expressed by the Committee on Depreciation. The committee said in part, "A number of commissions, both federal and state, have ruled that the accelerated depreciation provisions of the war emergency certificates should be handled for accounting purposes by establishing reserves against subsequent tax liability, thus insulating these savings against the demands of both the stockholder and the taxpayer.

Tax Deferral Maintained

"The Alabama commission, for one, has ruled that the same treatment is to be accorded under the new Code provisions (Re Alabama Power Co, Docket 1679, Feb. 28, 1955). There would, at least in theory, seem to be little difference between the two situations. Total depreciation credit for tax purposes under the new Code is still limited to original cost of the property, and if the utility, for the

purpose of conserving cash or for any other purpose wishes to adopt one of the alternative tax depreciation plans, it would seem to be perfectly proper that it do so. However, it would seem equally proper that it maintain a reserve based on straight line accounting so as to enable it to meet the increased taxes resulting from the subsequent diminished depreciation accruals."

With respect to regulatory lag, the committee noted that it was important to minimize the delay and that "We are confident that further improvement in this regard may be expected. Certainly, it is desirable if the tendency of the courts to take over the rate-making functions of the commissions is to be finally and definitely reversed."

Resolution Tabled

A resolution regarding perfecting amendments to revised System of Accounts submitted by the Committee of Accounts and Statistics was tabled by the Executive Committee.

However the NARUC adopted a resolution for an amendment to the Public Utility Holding Co Act of 1935. It stated that the experimental work and prospective development and construction of large power generating facilities using nuclear fuels is probable in the near future and the cost and work involved therein is likely to be too heavy for individual companies.

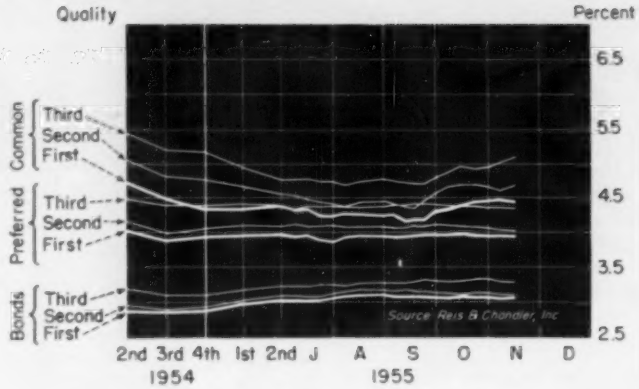
The resolution continued that the development and construction of such projects can often be financed jointly by two or more operating utilities forming a corporation, all the stock of which is owned by the operating utilities.

The resolution further said that the association of a group of these companies under such circumstances was not intended to come within the provisions of Section 2(a) (7) of the Public Utility Act of 1935. Therefore, the resolution concluded, the NARUC favors an amendment to the Act so as to exempt companies organized in such a manner.

The following officers were elected for the coming year: Benjamin F. Feinberg, chairman of the New York PSC, president; John C. Hammer, chairman of the Tennessee PSC, first vice president; and Edward R. Thornton, a commissioner of the New Hampshire PUC, second vice president.

The 1956 convention will be held in San Francisco during week of July 23 at Sheraton Palace Hotel.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Nov. 10	3.08	3.10	3.27	3.95	4.03	4.36	4.44	4.68	5.11
Nov. 3	3.07	3.10	3.27	3.96	4.04	4.37	4.47	4.61	5.02

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Florida Power & Light	12	Sept.	$13,006,136	$10,291,314	$1.93(a)	$1.70(a)
Iowa Southern Utilities Co.	12	Sept.	1,343,532	1,153,000	1.63(b)	1.38(b)
Montana Power Co & subsidiaries	12	Sept.	8,426,578	7,488,987	2.91	2.59
Niagara Mohawk Power Corporation	12	Sept.	28,687,979	26,798,098	2.16	2.04
Ohio Edison	12	Sept.	22,750,467	19,877,830	3.44(c)	3.02(c)
Oklahoma Gas & Electric	12	Sept.	8,085,603	6,583,948	2.24(f)	2.06(f)
Philadelphia Electric	12	Sept.	31,756,339	30,848,877	2.29(g)	2.25(g)

Notes—(a) Based on 6,000,000 shares in 1955 and 5,390,000 in 1954; (b) 752,483 shares in 1955 and 745,331 in 1954; (c) 5,806,136 shares in 1955 and 5,674,179 in 1954; (f) 2,984,783 shares in 1955 and 2,653,140 in 1954; (g) 12,164,078 shares in 1955 and 11,763,802 in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
NOVEMBER 10-16			
PREFERRED STOCK			
Central Electric & Gas—35,000 sh 4.75% $50 par	$1,750	$50.00	4.75%
COMMON STOCK			
Arizona Public Service—260,000 sh	$5,915	$22.75	4.40%
SCHEDULE FOR NOVEMBER—DECEMBER			
BONDS			BID DATE
San Diego Gas & Electric—1st mtg due 1985	$18,000		Nov. 29
Consolidated Edison—1st mtg due 1985	70,000		Dec. 6
Delaware Power & Light—1st mtg due 1985	10,000		Dec. 13
PREFERRED STOCK			
Virginia Electric & Power—125,000 sh $100 par	$12,500		Dec. 6
Delaware Power & Light—50,000 sh $100 par	5,000		Dec. 13
COMMON STOCK			
Rochester Gas & Electric—200,000 sh (to be offered commonholders on 1-for-7 basis, record Nov. 25)			
Columbus & Southern Ohio Electric—250,000 (a)			

Notes—Underwriters (a) Dillon, Read & Co.

This tube is designed to act as an insulating conduit or pipe, to carry a blast of air close to the jaws of an airbreak switch. As the switch opens and the arc initiates, the air blast, directed at the arc, cools and "blows it out."

The piece is 54″ long, 1½″ inside diameter, with a ¾″ wall thickness, unusually long and slender as high-voltage porcelain insulating parts go. To maintain straightness, it is suspended in the kiln during firing; and because the temperature required for complete vitrification is somewhat beyond the softening point of the body, there is a problem of the ability of such a piece to support its own weight.

The piece is produced as a clay extrusion from a pug mill, dried, and lathe-turned to a templet. Ability to produce a piece of such length and small diameter by lathe-turning of "stock" of the low strength of unfired porcelain, is a special Lapp skill.

The plant superintendent says that this is not a particularly difficult piece. And that's a pretty good indication of how far Lapp has come in its ability to handle, as routine production, porcelain parts which in an earlier day would have been so difficult of manufacture that they wouldn't even have been designed.

Back of this ability is experience in the production of porcelain insulating parts requiring a wide range of manufacturing and control techniques. And that's a sound basis for the confidence of the entire industry on the mechanical and electrical security of porcelain by Lapp. On the porcelain components of equipment on your system . . . on the insulators carrying your transmission lines . . . the name LAPP is a guarantee of operating dependability, long life, low upkeep.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

STATISTICS

Census of Television Sets in the United States

(Percent Distribution as of June 1955)

Area	No. of Sets in Household	
	None	1 or more
United States	32.8	67.2
Inside metropolitan areas	21.7	78.3
Outside metropolitan areas	50.3	49.7
Northeast	20.3	79.7
Inside metropolitan areas	17.8	82.2
Outside metropolitan areas	30.9	69.1
North Central	28.2	71.8
Inside metropolitan areas	19.1	80.9
Outside metropolitan areas	41.4	58.6
South	46.8	53.2
Inside metropolitan areas	29.1	70.9
Outside metropolitan areas	60.3	39.7
West	37.9	62.1
Inside metropolitan areas	26.0	74.0
Outside metropolitan areas	59.5	40.5

Residence and Size of Place	No. of Sets in Household	
	None	1 or more
Urban	26.5	73.5
In urbanized areas	21.0	79.0
of 3 million or more	19.5	80.5
of 1 to 3 million	18.0	82.0
of 250,000 to 1 million	21.5	78.5
under 250,000	25.6	74.4
Not in urbanized areas	44.3	55.7
Places of 10,000 or more	37.6	62.4
Places under 10,000	48.0	52.0
Rural nonfarm	38.7	61.3
Rural farm	57.7	42.3
Size of Household		
1 person	64.4	35.6
2 persons	36.1	63.9
3 persons	26.6	73.4
4 persons	20.9	79.1
5 persons	22.2	77.8
6 persons or more	33.7	66.3

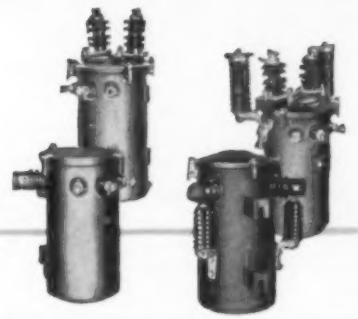
Source: Bureau of Census, U.S. Department of Commerce

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	110.91	110.03	99.16	11.8
Peak-class I Systems . . . million kw	Aug.	91.6	89.3	79.7	14.9
Estimated Dec. '55 Peak	Aug.	96.54	96.30	95.95	0.6
Production-billion kwhr	Aug.	49.35	46.63	41.17	19.8
Hydro		9.53	9.35	8.34	14.3
Fuel		39.82	37.28	32.82	21.2
Sales-billion kwhr	Aug.	43.44	40.89	36.28	19.7
Residential		10.46	9.89	9.30	12.5
Commercial		7.39	6.92	6.56	12.7
Industrial		22.84	21.50	17.80	28.3
Other		2.74	2.59	2.62	4.6
Fuel Consumption	Aug.				
Coal-million tons		12.59	11.72	9.83	28.1
Oil-million barrels		5.37	4.62	4.84	10.9
Gas—billion cu ft		132.55	126.25	130.51	1.6
Net Income Class A & B Co's—$ million	Aug.	93.95	89.87	88.98	5.6
Residential Customers—millions	12 mos.	43.83	43.74	42.57	3.0
Revenue per kwhr	ended	2.66¢	2.67¢	2.71¢	−1.9
Avg kwhr per customer	July	2,662	2,649	2,459	8.3
Avg annual bill		$70.81	$70.73	$66.64	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Sept.	141	139	126	11.9
ENR Construction Cost	Oct.	141.2	141.0	134.6	4.9
BLS Cost-of-living	Sept.	114.9	114.5	114.7	0.2
NEMA Sales	Aug.				
Insulation materials		147	117	111	32.4
Electric appliances		111	97	91	22.0
Household refrigerators		86	89	71	21.1
Wholesale prices	Sept.				
Motors and generators		124.1	121.8	122.9	1.0
Transformers and regulators		128.7	127.3	128.1	0.5
Switchgear and fuses		144.2	139.2	135.1	6.7
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3



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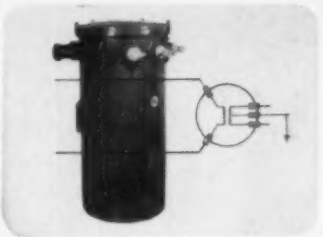

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